FINAL

Work Plan

Non-Time-Critical Removal Action at the Municipality of Culebra, Puerto Rico

Prepared for

United States Army District, Jacksonville
United States Army Engineering and Support Center, Huntsville

Contract Number: W912DY-05-D-0007
Task Order Number: 0001
Project Number: I02PR006802

Prepared by

Ellis Environmental Group, LC
414 SW 140 Terrace, Newberry, FL 32669 • (352) 332-3888

January 2006
Revised March 2006

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John D. Scott, PE, EEG Quality Control Manager

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Independent Technical Review Certification

Responsibility Name	Company	Signature & Date
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Abbreviations & Acronyms

°F	degrees Fahrenheit
AR	Army Regulation
ARAR	applicable or relevant and appropriate requirement
ASR	Archives Search Report
ATF	(Bureau of) Alcohol, Tobacco, and Firearms
ATFP	Alcohol, Tobacco, and Firearms Publication
BEM	buried explosion module
CADD	computer-aided design and drafting
CAIRA	Chemical Accident or Incident Response and Assistance
CAP	contractor-acquired property
CEHNC	United States Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAJ	United States Army Corps of Engineers, Jacksonville District
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CWM	chemical warfare materiel
DA PAM	Department of the Army Pamphlet
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DID	Data Item Description
DNER	Department of Natural and Environmental Resources
DoD	Department of Defense
EE/CA	Engineering Evaluation / Cost Analysis
EEG	Ellis Environmental Group, LC
EM	Engineer Manual
EMR	electromagnetic radiation
EOD	explosive ordnance disposal
EP	Engineer Pamphlet
EPA	Environmental Protection Agency
EQB	Environmental Quality Board
ER	Engineer Regulation
ESA	Endangered Species Act
ESE	Environmental Science and Engineering, Inc.
FAR	Federal Acquisition Regulation
FGDC	Federal Geographic Data Committee
FUDS	Formerly Used Defense Sites
FWS	Fish and Wildlife Service
GFP	government-furnished property

GIS	geographic information system
GPS	global positioning system
HAZWOPER	hazardous waste operations and emergency response
HD	Hazard Division
HQDA	Headquarters Department of the Army
HTRW	hazardous, toxic, and radioactive waste
ID	identification
IDW	investigation-derived waste
IME	Institute of Makers of Explosives
MC	munitions constituents
MD	munitions debris
MEC	munitions and explosives of concern
MGFD	munitions with the greatest fragmentation distance
mm	millimeter
MMRP	Military Munitions Response Program
MPPEH	material potentially presenting an explosive hazard
MSD	minimum separation distance
NAVD88	North American Vertical Datum of 1988
NEW	net explosive weight
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NMFS	National Marine Fisheries Service
OB/OD	open burning / open detonation
OE	ordnance and explosives
OOU	ordnance operating unit
OSHA	Occupational Safety and Health Administration
PDF	Portable Document Format
PETN	pentaerythritol tetranitrate
PPE	personal protective equipment
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
QCP	Quality Control Plan
Q-D	quantity-distance
RCWM	recovered chemical warfare materiel
SDSFIE	Spatial Data Standards for Facilities Infrastructure and Environment
SDTS	Spatial Data Transfer Standard
SOW	scope of work
SUXOS	senior unexploded ordnance supervisor
TB	Technical Bulletin

TM	Technical Manual
TP	Technical Paper
TPP	Technical Project Planning
USACE	United States Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
UXOQC/SO	unexploded ordnance quality control / safety officer

1.0 Introduction

1.1 General Information

1.1.01 Ellis Environmental Group, LC (EEG), under contract to the United States Army Engineering and Support Center, Huntsville (CEHNC), is providing non-time-critical removal operations on Culebra Island and adjacent islands, or cays, in Puerto Rico. This area was used during the period 1903 through 1975 by the Department of Defense (DoD) for numerous military maneuvers and range training.

1.1.02 The Findings and Determination of Eligibility, dated December 24, 1991, qualified 2,660 acres of Culebra Island and adjacent cays as eligible for consideration under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS); however, upon subsequent review of historical material from the National Archives, it was determined that all of Culebra Island and the adjacent cays should be considered a FUDS.

1.1.03 The United States Army Corps of Engineers (USACE), Rock Island District, compiled an Archives Search Report (ASR) dated February 1995. The ASR determined the types, quantities, and probable locations of munitions and explosives of concern (MEC) remaining at the Culebra Island National Wildlife Refuge. The ASR identified 32 suspected ordnance areas. Ordnance was verified at 11 sites. These sites included the Northwest Peninsula and Flamenco Beach[1] (bombing and naval bombardment range), Cerro Balcon (mortar range), Isla Culebrita (strafing range and torpedo range), and Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Gayos Genequi, Cayo Lobo, and Cayo Alcarraza (all aerial bombardment sites).

[1] Work at Northwest Peninsula and Flamenco Beach is specifically excluded from any action under the present work plan. USACE's participation in the reasonable cleanup of Culebra and surrounding cays is subject to the obligations and restrictions set forth in Section 204(c) of the MILCON Act of 1974, Public Law 93-166. This Act prohibits the use of federal funds to decontaminate the area referenced in Section 204(c). As a result, the "present bombardment area" on the island of Culebra shall not be utilized for any purpose that would require decontamination at the expense of the United States. In addition, Section 9 of the quitclaim deed from the United States to the Commonwealth states: "In accordance with the provisions of Section 204 of Public Law 93-166, that portion of the subject property which has heretofore been used as a bombardment area by the United States Navy is hereby accepted by Grantee in its present condition and further agrees that the United States shall not in any manner be responsible for decontamination of such area, nor for the costs thereof, but the same is and shall be solely (sic) the responsibility of the Grantee." Detailed analysis of all currently available information indicates that this "present bombardment area" is limited to an area on the northwest peninsula of Culebra. As stated in the Preliminary Points of Agreement (PPA) (Appendix A of this Work Plan), the Commonwealth does not necessarily agree with the interpretation, application of Section 204, and/or legal significance of this legal provision; however, USACE and the Commonwealth have willingly entered into the PPA without renouncing or disclaiming any legal or factual claims they may have and may invoke them at a later time. Despite the legal differences, USACE and the Commonwealth desire to investigate and take appropriate response actions to respond to threats to public health and the environment from past military activities in Culebra.

1.1.04 Environmental Science and Engineering, Inc. (ESE) conducted an Engineering Evaluation / Cost Analysis (EE/CA) investigation of these sites in October 1995. The EE/CA investigation was performed in accordance with DERP-FUDS; the National Oil and Hazardous Substances Pollution Contingency Plan, commonly called the National Contingency Plan; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly called Superfund; and relevant United States Army regulations and guidance for ordnance and explosive waste programs. In the EE/CA Report (ESE 1996), ESE characterized the type of ordnance found and assessed the exposure potential at each of the sites based on the statistical sampling of randomly placed grids at each of the 11 sites. ESE then evaluated several remedial action alternatives based on the nine CERCLA evaluation criteria.

1.1.05 ESE identified five separate ordnance operable units (OOUs) based on location, previous land usage, and similar geographical characteristics. The selected remedial alternatives included clearance for use at Flamenco Beach (OOU-1) and the Northwest Peninsula (OOU-2), and surface clearance of MEC and munitions constituents (MC) at Cerro Balcon (OOU-3), Isla Culebrita (OOU-4), and the adjacent cays (OOU-5), including Cayo Botela, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza. An EE/CA Action Memorandum (ESE 1997) was filed which identified clean-up options and was approved by DoD.

1.1.06 This Non-Time-Critical Removal Action Plan is created to implement the surface removal actions presently approved at Cerro Balcon, Isla Culebrita, Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Gayos Genequi, Cayo Lobo, and Cayo Alcarraza.

1.1.07 Recently, USACE St. Louis District was enlisted by the USACE Jacksonville District (CESAJ) to conduct further archive searches to supplement the data from the initial ASR. The supplemental ASR adds to the findings of the original ASR prepared by USACE in February 1995 (USACE 2004) and identified additional areas of potential concern for Culebra and the adjacent cays. The data from these findings will be the basis of future investigations and removal actions.

1.2 Site Location

1.2.01 Adjacent to Culebra Island are about 24 cays, mostly owned by the United States Fish and Wildlife Service (FWS). The total land area is approximately 7,300 acres, of which approximately 1,500 acres are owned by FWS. The Commonwealth of Puerto Rico owns the remainder, of which approximately 1,200 acres are primarily in the custody of the Puerto Rico Department of Natural and Environmental Resources (DNER) and approximately 4,600 acres are owned by private citizens and the Municipality of Culebra. DNER ownership extends from the high-tide mark to 9 nautical miles out.

1.2.02 Culebra Island is separated from Puerto Rico by about 17 miles of Vieques Sound. The Caribbean Sea lies to the south, and the Atlantic Ocean lies to the north. The warm, clear waters provide a home for a wide variety of sea life that attracts scuba divers from all over the world.

1.2.03 Surface clearance of MEC will be conducted over 30 acres on the western flank of Cerro Balcon, 82 acres of the northwest end of Isla Culebra, and up to 39.5 acres of additional cays, including Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza. Appendix B (Map B-1) provides the locations of these sites.

1.3 Site History

1.3.01 Ships with heavy armaments and carriers of the United States Navy and the North Atlantic Treaty Organization used the former Culebra Island naval facility on Culebra Island, Puerto Rico, for training. Facilities constructed by the Navy included a desalination plant, an airfield, barracks, helicopter pads, range instrumentation facilities, gun sites (for the defense of the islands), observation points, and impact ranges for aerial bombs and rockets, missiles, mortars, and naval ordnance.

1.3.02 Culebra Island and adjacent cays were used as an impact range for aerial bombs and rockets, missiles, mortars, and naval projectiles from 1903 until 1975. The Marines used Culebra Island as a training facility from 1903 until 1941, during which time a rifle range was constructed at the airfield site. The United States Caribbean fleet used Culebra Island and the adjacent cays for naval exercises throughout its history. A large fleet exercise was conducted from December 1923 through February 1924. Approximately 3,300 Marines participated in the maneuvers armed with 155-millimeter (mm) guns, 75 mm guns, and machine guns. The exercise involved the 5th Marine Corps Regiment, which included a “gas platoon.” This is the only indication of the possible presence of chemical warfare materiel (CWM). Another fleet exercise was conducted from January through March 1935.

1.3.03 The Navy abandoned the lower camp area in 1920. This area was re-activated in 1942 before its reduction to caretaker status in 1944. Culebra Island was used as a bombing and gunnery range from 1935 through 1975. Naval records indicate bombardment of Flamenco Peninsula in 1936 and again in 1949.

1.3.04 The Navy also conducted submarine warfare maneuvers. Fourteen live torpedoes were fired at Cayos Geniqui in November 1959, and records indicate that submarines also fired torpedoes at Marcs Point on Isla Culebrita. The firing of torpedoes within the area of Culebra and the adjacent cays ceased prior to 1969.

1.3.05 Until the early 1960s, Flamenco Peninsula, Los Gemelos, and Alcarraza were the only aircraft targets in the complex. To support increased training needs during Vietnam operations, the Navy acquired additional training areas on cays east and west of Culebra Island for use as aircraft ranges. Navy records indicate that Flamenco Peninsula was the target area for naval gunfire support training. Ships fired from ranges of 2,000 to 12,000 yards. In 1969, ships fired live 40 mm, 3-inch, 5-inch, 6-inch, and 8-inch rounds. It is likely that 81 mm illuminating rounds were also fired. Ships from Great Britain, Canada, Germany, Netherlands, France, Brazil, Columbia, and Venezuela also used Flamenco Peninsula target facilities.

1.3.06 In 1964, the target range was expanded to the eastern and western cays. Aerial mining operations were also conducted in these outlying areas. Live ordnance operations reached their peak in 1969, when the fleet was training pilots for Vietnam. Aircraft bombing and strafing of Flamenco Peninsula ended in 1970, and the use of live rounds for naval gunfire support training ended in 1971. Subsequent naval support training was conducted using quarter puff rounds until ordnance use was terminated on September 30, 1975.

1.4 Topography

1.4.01 Culebra Island is underlain by both intrusive and extrusive volcanic rock of the Upper Cretaceous Age. The volcanic rock exhibits little or no porosity due to compaction and filling of the pores with quartz and calcite. The volcanic rocks exhibit strong magnetic properties that can affect magnetometer readings.

1.4.02 Culebra Island (598 acres) has sandy beaches, irregular rugged coastlines, lagoons, coastal wetlands, steep hills, and narrow valleys. Ninety percent of the island is hilly, with population concentrations in the flatlands. The highest point on Culebra Island is Monte Resaca, which is approximately 630 feet above mean sea level. The island has a limited variety of soil types due to its volcanic origin, limited size, rugged terrain, and moderately uniform climate.

Most soils, except along the slopes, are the result of weathering bedrock. The Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate.

1.4.03 Fresh water is scarce on the island, and it is high in chloride and saline. Most residents get their water from a desalination plant installed by the Navy at the lower camp and from some shallow (10 to 20 feet deep) wells and a water line from the Island of Puerto Rico. Surface water is also scarce, and creeks and streams are intermittent and seasonal. Normally they are dry and collect and drain runoff water only during rainstorms. Approximately 12 natural springs and seeps exist, but they are charged only during particularly wet seasons.

1.4.04 The National Oceanic and Atmospheric Administration estimates that water depths average approximately 70 to 90 feet in the areas surrounding Culebra Island; however, some areas west of Flamenco Peninsula and east of Cayos Geniqui are more than 130 feet deep. Local maritime charts show "Caution unexploded ordnance (UXO)" in the northern and western areas. Tidal data for Culebra Island indicates that tides are chiefly diurnal. The height difference between mean higher high water and mean lower low water is 1.1 feet. The mean tide level is 0.6 foot.

1.5 Climate

Culebra Island has a tropical marine climate, with a year-round average daily temperature of 80 degrees Fahrenheit (°F). The average rainfall is 36 inches, and the average humidity is approximately 73 percent, with a daytime average of approximately 65 percent and a nighttime average of approximately 80 percent. The most humid months are August through January, although the humidity in the remaining months is only slightly lower. Prevailing winds are from the east-northeast for November through January and from the east for the rest of the year. Average wind speed is 8 knots. The hurricane season is from June through November, with most storms occurring July through September. Severe hurricanes occur through this area every 15 to 33 years.

1.6 Geology

1.6.01 Puerto Rico and its outlying islands are part of an island arc that largely consists of faulted and folded vulcaniclastic and sedimentary rock, which is locally intruded by igneous rock. These rocks range from Cretaceous to Eocene in age (USGS 1999).

1.6.02 Culebra and the adjacent cays are underlain by volcanic and intrusive rocks of Upper Cretaceous Age. Andesite lava and andesite tuff are clearly dominant. Toward the north-central part of Culebra and on eastern Cayo Luis Pena, the tuff and lava contain diorite porphyry inclusions. These volcanic rocks no longer exhibit porosity, due to compaction and the filling of pores with quartz and calcite (USACE-RI 1995).

1.6.03 The bedrock beneath most of Culebra is andesite lava and lava breccia. This material is generally overlain by a thin (generally 2 to 3 feet thick) layer of disturbed saprolite (USACE-RI 1995). In the area of the project sites, the ground surface has been impacted by the detonation of ordnance as part of DoD activities, which may have locally fractured some of the rock.

1.7 Hydrogeology

1.7.01 About a dozen natural springs and seeps exist on Culebra Island, but they are charged only after particularly wet seasons. Some wells 10 to 20 feet deep exist in areas away from coastal seepage, but these wells are high in chloride concentrations and salinity. As a result, most Culebra citizens get their fresh water from the desalinization plant installed by the Navy at the lower camp or from a potable-water pipeline that connects Culebra with the main island of Puerto Rico (USACE-RI 1995).

1.7.02 Due to the shallow bedrock and impermeability of the lava and overlying soil, the potential for use of groundwater as a potable domestic, municipal, or commercial water source is virtually nonexistent. No significant aquifers are on Culebra Island and the adjacent cays.

2.0 Technical Management Plan

2.1 Guidance, Regulations, and Policy

This Technical Management Plan details the approach, methods, and operational procedures to be used to perform all surface clearance actions of MEC on Culebra Island and adjacent cays, in Puerto Rico. The work to be completed during this task order will comply with the Scope of Work (SOW) (included as Appendix A), this Work Plan (including all appendices), and the following reference documents:

- CERCLA of 1980, Public Law 96-510, 94 Stat. 2767, 42 United States Code (USC) 9601, Chapter 103
- Puerto Rico Law 134, "Explosives"
- 27 Code of Federal Regulations (CFR) Part 555, Commerce in Explosives
- 29 CFR, Labor Standards
- 29 CFR 1910.120/1926, Occupational Safety and Health Standards
- 49 CFR Parts 100-199, Transportation
- 40 CFR, Parts 260 through 270, United States Printing Office latest edition
- 40 CFR, Part 300, Environmental Protection Agency (EPA) National Contingency Plan
- Federal Acquisition Regulation (FAR) 45.5 and its supplements, Management of Government Property in the Possession of Contractors
- DoD 4160.21-M, Defense Materiel Disposition Manual
- DoD 4160.21-M-1, Defense Demilitarization Manual
- DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards
- AR 190-11, Physical Security of Arms, Ammunition, and Explosives
- AR 200-1, Environmental Protection and Enhancement
- AR 385-10, The Army Safety Program
- AR 385-40, Accident Reporting and Records with USACE Supplement
- AR 385-64, United States Army Explosives Safety Program
- DA PAM 385-64, Ammunition and Explosives Safety Standards
- Headquarters, Department of the Army (HQDA) Letter 385-00-2, DACS-SF, Explosives Safety Policy for Real Property Containing Conventional Ordnance & Explosives Response Activities, 30 June 2000
- Materiel Response Activity Interim Guidance, 19 March 1998
- HQDA Policy Memorandum, Munitions Response Terminology, 21 April 2005

- Engineer Regulation (ER) 200-3-1, FUDS Program Policy
- ER 385-1-92, Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities
- ER 385-1-95, Safety and Health Requirements for Ordnance and Explosives (OE) Operations
- ER 1110-1-8153, Ordnance and Explosives Response
- Engineer Pamphlet (EP) 75-1-2, UXO Support During HTRW and Construction Activities
- EP 385-1-95a, Basic Safety Concepts and Considerations for Munitions and Explosives of Concern (MEC) Response Action Operations
- EP 1110-1-17, Establishing a Temporary Open Burn and Open Detonation Site for Conventional Ordnance and Explosives Projects
- EP 1110-1-18, Ordnance and Explosives Response
- Attachment to Chapter 20, EP 1110-1-18, UXO Personnel and Experience Hierarchy
- Engineer Manual (EM) 200-2-1, Technical Project Planning (TPP) Process
- EM 385-1-1, Safety and Health Requirements Manual
- EM 1110-1-1200, Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive Waste (HTRW) Projects
- EM 1110-1-4009, Engineering and Design, Ordnance and Explosives Response
- Pertinent government-furnished unclassified Technical Manual (TM) 60-series publications
- TM 60A-1-1-31, EOD Procedures: General Information on EOD Disposal Procedures
- TM 60A-1-1-22, EOD Procedures: General EOD Safety Precautions
- NIOSH (National Institute for Occupational Safety and Health) / OSHA (Occupational Safety and Health Administration) / USCG (United States Coast Guard) / EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, October 1985
- Alcohol, Tobacco, and Firearms Publication (ATFP) 5400.7, Alcohol, Tobacco, and Firearms Explosive Laws and Regulations
- TM 9-1300-200, Ammunition General
- TM 9-1300-214, Military Explosives
- TM 9-1375-213-12, Operator’s and Organization Maintenance Manual (Including Repair Parts and Special Tools List); Demolition Materials

- Technical Bulletin (TB) 700-2, Department of Defense Ammunitions & Explosive Hazardous Classification Procedures
- Procedures for Demolition of Multiple Rounds (Consolidated Shots) on OE Sites, August 1998 (terminology update March 2000)
- Technical Paper (TP) 16, Methodologies for Calculating Primary Fragment Distances, Department of Defense Explosives Safety Board (DDESB)

2.2 Recovered Chemical Warfare Materiel

A review of the records indicates that no CWM was employed at this site; therefore, exposure to chemical warfare materiel is not anticipated. If MEC personnel encounter any item that cannot positively be identified as conventional MEC, EEG personnel will cease the operation immediately, evacuate, and secure an area 500 meters around the item. UXO personnel will take a position 50 meters upwind of the MEC, in an area where the site can be observed at all times. The CEHNC safety specialist, the CEHNC project manager, and the Huntsville CW Design Center (Mr. Wilson Walters) at 256-895-1578 will be notified of the situation.

2.3 Munitions and Explosives of Concern and Off-Site Disposal

2.3.01 **Table 2-1** provides a summary of MEC suspected to be encountered in each removal area.

Table 2-1. Expected Munitions and Associated Removal Areas

Removal Area	Possible Munitions
Cerro Balcon	81 mm practice HE mortar, 3-inch Stokes, 4.2-inch mortar, *75 mm projectile*
Isla Culebrita	*20 mm HEI,* 75 mm projectile
Cayo Botella	*6-inch naval projectile*, MK 76 practice bomb with MK 4 fuze
Cayo Alcarraza	*MK 83 1,000-pound bomb*
Los Gemelos	*MK 83 1,000-pound bomb*, Bullpup with inert warhead
Cayo Lobo	*MK 76 25-pound practice bomb* with Mk4 spotting charge
Cayo del Agua	*76mm HE*, MK 76 practice bomb
Cayo Tiburon	*MK 83 1,000-pound bomb*
Cayos Genequi	*MK 82 500-pound bomb*
Italicized items = MGFD	

2.3.02 It is planned that all MEC disposals will be completed on site. In case of a situation that prevents the destruction of MEC on site, the CEHNC safety specialist will be notified.

2.3.03 After positive identification (ID) of an item and determination of fuze condition, MEC that is determined by the senior UXO supervisor (SUXOS), the UXO quality control / safety officer (UXOQC/SO), and the CEHNC safety specialist to be acceptable to move may be carefully moved for consolidation with other items within the site prior to destruction.. The item will be carefully placed into a container, prepared by placing a layer of sand on the bottom to restrict movement and mitigate shock. Larger ordnance items may be loaded onto the transport vehicle without containerization as long as they can be properly secured to the vehicle to prevent movement. Items deemed acceptable to move by CEHNC will not contain any means of self-detonation or active fuzing.

2.3.1 Transportation of MEC

Transportation of MEC will be performed as detailed in Chapter 3.

2.3.2 Temporary Storage of MEC

Temporary storage of MEC is not anticipated on this project.

2.3.3 Off-Site Disposal Alternatives

Due to the nature of the suspected MEC and MC materials, and the remote nature of all sites within this task order, the need for off-site disposal is not anticipated.

2.3.4 Unidentifiable MEC

If unidentifiable MEC is discovered, the default separation distance specified in DDESB TP 16 will be used. The minimum separation distances (MSDs) will not be less than 1,250 feet. The OE safety specialist will be contacted for assistance in identifying the MEC. As per EP-385-1-95a, Section 9a, MEC Procedures Safety Precautions: “Every effort will be made to identify a suspect military munition. Under no circumstances will any MEC be moved in an attempt to make a definitive identification. The military munition will be visually examined for markings and other external features such as shape, size, and external fittings.”

2.4 Technical Scope of the Project

The SOW for this project is included as Appendix A of this Work Plan. The tasks included are discussed in the following subchapters.

2.4.1 Site Preparation

2.4.1.1 Grid Layout

The grid corners will be determined by the map projection locations of the grid corners of a 200-by-200-foot grid using the geographic information system (GIS). The coordinates of the grid corners will be given to a Puerto Rico-licensed surveyor, to locate the grid corners in the field. The surveyor will provide the actual coordinates and elevations of the corners to sub-meter accuracy. Actual grid areas will be calculated using the measured sides of the grid in the field. Grid maps of the sites are presented in Appendix B.

2.4.1.2 Lane Width

After the boundaries have been marked, lanes (no wider than 4 feet) will be established in a pattern that will allow MEC personnel optimum sweep rates. The location of MEC will be recorded using a global positioning system (GPS), and all related information (i.e., size and condition) will be recorded in a field log.

2.4.2 Tools and Techniques

2.4.2.1 Vegetation Clearance

2.4.2.1.01 Prior to performing vegetation clearance, a qualified tropical botanist will survey the area of the investigation to identify protected species and habitats. All protected trees and habitats found will be delineated and placed on a map. EEG will follow protected species protocols provided in Appendix J.

2.4.2.1.02 EEG will use a variety of vegetation-removal equipment to include a bladed trimmer with several types of blades to cut vegetation from the site grids. The least amount of vegetation will be removed to allow EEG UXO personnel to properly work the geophysical equipment to locate surface anomalies. EEG personnel will wear the proper personal protective equipment (PPE) for the safe operation of this equipment.

2.4.2.1.03 When tree removal is necessary, a chain saw will be used to cut trees and limbs less than 2 inches in diameter. Larger trees and limbs will be cut only as a last resort.

2.4.2.1.04 Vegetation removal will first be conducted along the grid boundaries and later within the grids to ensure that the boundaries are properly located.

2.4.2.2 Description of the Ordnance Locators to be Used

As the SOW involves a surface removal operation, EEG is preparing to use White's Spectrum XLT electromagnetic detectors to aid in visual detection of MPPEH at the surface (however, other equipment may be used upon CEHNC request). This instrument has been chosen due to its ability to detect MPPEH in areas of highly mineralized soils. The White's electromagnetic detectors will be able to detect items as small as a 20 mm projectile at or near the surface at the site. Further description of the geophysical equipment and the operation is provided in Chapter 6 of this Work Plan.

2.4.2.3 Location Survey

2.4.2.3.01 Geospatial data will be collected in accordance with DID MR-005-07. EEG will use a Puerto Rico-licensed surveyor to determine the coordinates of the grid corners using the presently existing benchmarks to Class I Third Order or better. The Puerto Rico-licensed surveyor will use either differential (post-processing) or kinematic survey techniques to determine the locations of the grid corners to sub-centimeter accuracies.

2.4.2.3.02 During the field effort, EEG will determine the locations of the MEC and the demolition locations using a Trimble ProXR GPS. The accuracy and methods are discussed in Chapter 7 of this plan.

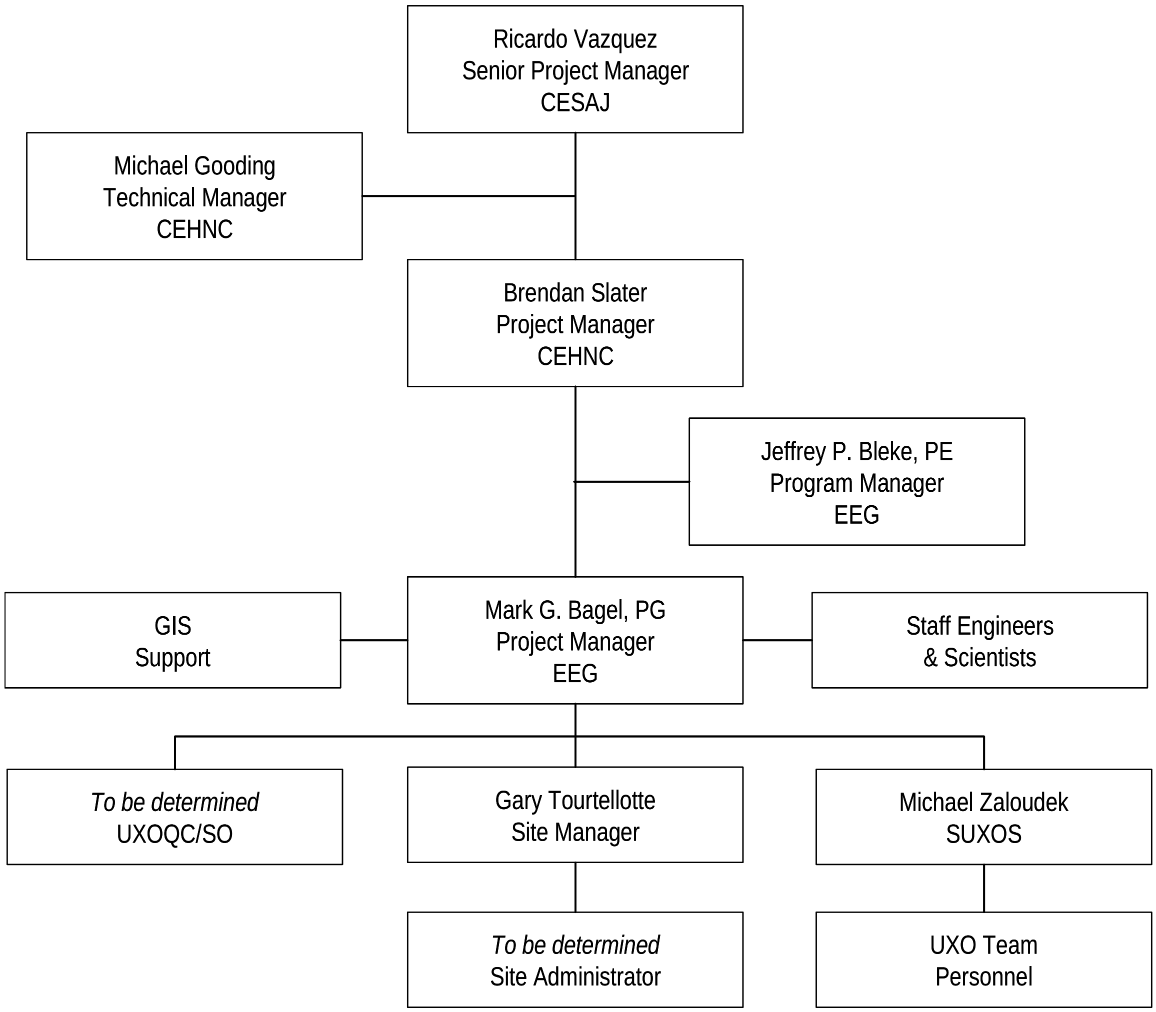
2.5 Procedures for Changed Site Conditions

In the event of changed site conditions, the contracting officer will be notified immediately in accordance with FAR Part 52.

2.6 Project Organization

The organizational chart in **Figure 2-1** depicts the organizations and key personnel involved in this project, and the subchapters following provide brief descriptions of their responsibilities.

Figure 2-1. Project Organization Chart



2.6.1 US Army Corps of Engineers, Jacksonville District

CESAJ is the life cycle project manager and is responsible for the overall project. CESAJ responsibilities include coordinating for site access, reviewing project work plans and documents, communicating with the news media and public, and coordinating with state and local regulatory agencies.

2.6.2 US Army Engineering and Support Center, Huntsville

CEHNC is the MEC Design Center for this project and has approval authority for project execution. CEHNC responsibilities include providing expertise for MEC-related activities, procuring MEC contractor services and directing the MEC contractor, controlling the budget and schedule, and coordinating document reviews. Michael Gooding is the technical manager for CEHNC, while Brendan Slater will be the project manager.

2.6.3 Ellis Environmental Group, LC

EEG is the prime contractor to CEHNC and will provide all engineering support and MPPEH investigation and removal services. EEG is responsible for performance of the activities detailed in the SOW (Appendix A), including developing the Work Plan, participating in community relations activities, and conducting the MPPEH ID and removal operations. EEG personnel will closely monitor the project budget and schedule. The following subchapters summarize the key personnel who will be required in the technical management of the project.

2.6.3.1 Program Manager

The program manager is Jeffrey P. Bleke. He is responsible for ensuring that contract requirements are being met on all task orders issued under this contract.

2.6.3.2 Project Manager

The project manager is Mark Bagel. He is responsible for all aspects of the project, including ensuring the quality of all products and services provided as part of this SOW, and ensuring that all deliverables satisfy project requirements and are conducted in accordance with the DIDs, specific portions of the Work Plan, and portions of the attached appendices. His responsibilities include:

- Project planning and execution
- Implementing all of the plans provided within the Work Plan
- Interfacing with quality control (QC) and safety personnel as required in plans
- Coordinating improvements to the Quality Control Plan (QCP) plan based on suitability reviews
- Obtaining and communicating client requirements to the appropriate personnel
- Ensuring that qualified, skilled, and trained personnel and other resources are available for project execution
- Ensuring that products and services satisfy client requirements in all areas, including quality, safety, cost, schedule, performance, reliability, durability, accuracy, and maintainability

- Ensuring that personnel comply with applicable standards, regulations, specifications, and documentation procedures

2.6.3.3 UXO Quality Control / Safety Officer

The UXOQC/SO (to be determined) will be supplied by EEG and will be responsible for:

- Implementing the QCP and Accident Prevention Plan in the field
- Conducting QC and safety audits and meetings
- Preparing safety and QC reports

2.6.3.4 Senior UXO Supervisor

The SUXOS is Michael Zaloudek. He is responsible for the day-to-day on-site management during MPPEH ID and MEC removal operations and coordination with the EEG UXOQC/SO and project manager.

2.6.3.5 Staff Engineers and Scientists

Staff engineers and scientists are responsible for implementing, documenting, and maintaining aspects of this Work Plan, including but not limited to the Sampling and Analysis Plan (Appendix E) and the Geophysical Investigation Plan (Chapter 6).

2.6.3.6 UXO Team Personnel

2.6.3.6.01 UXO team composition will vary depending upon the task at hand. In all cases, the teams will be composed of no more than five UXO Technician I and/or UXO Technician II personnel. A UXO Technician III will be the team leader and immediate supervisor. Sweep personnel may be used in place of a UXO Technician I where the operations involve the use of heavy equipment or tasks that will not require exposure to or handling of MEC items. EEG will have one UXO Technician II to perform MEC avoidance for the GPS survey team.

2.6.3.6.02 UXO team personnel (including a team leader, UXO Technician II, UXO Technician I, and sweep personnel) may be involved with brush clearance, survey and mapping escort, and heavy equipment operations. Only UXO personnel (team leaders, UXO Technician II, UXO Technician I) will perform MEC search, removal, and disposal operations.

- Escorting non-UXO personnel performing other tasks in the work area (e.g., survey personnel) to ensure MEC avoidance

- Operating electromagnetic devices
- Locating, marking, and recording the locations of all MC and MEC and ordnance-related materials found during the removal action
- Identifying and classifying MC and MEC
- Conducting explosive disposal procedures of MC and MEC
- Inspecting, removing, and segregating all scrap
- Performing MC and MEC operations as directed by the SUXOS

2.6.3.7 Site Manager

The site manager will be Gary Tourtellotte. He will be responsible for performing all database management, purchasing, supplies pickup, cost tracking, explosives tracking, data log book review and compilations, and GPS data collection and management. He will provide data to the project manager for weekly reports and assist the project team in site planning, provide weather updates, and provide a direct line of communication between the site and CEHNC project management and CESAJ community relations personnel. He will also be responsible for supervising environmental sampling at this site and proper completion of the chain-of-custody forms, the Chemical Quality Control Reports, and other sampling forms.

2.6.3.8 Site Administrator

The site administrator (to be determined) will be a part-time to full-time local hire with bilingual capabilities. He or she will know how to use Microsoft Word, Excel, and possibly Access software, and will assist with tracking costs, preparing bilingual documents, taking notes during public meetings, and providing assistance to the project manager and site manager as necessary.

2.7 Project Mobilization

The project manager and the SUXOS will require two weeks for logistics set-up at the site, including laying out initial grids, preparing the office, collecting supplies and equipment, and assessing site conditions. The project manager will remain on site until operations are smoothly underway and will spend at least three weeks with the site manager setting up for the field effort prior to mobilization.

2.7.1 Premobilization Activities

2.7.1.01 Prior to mobilization, the EEG project manager will submit the names and resumés (or UXO database ID numbers) to the CEHNC project manager for approval. EEG's project manager is responsible for ensuring that the experience levels of proposed project personnel meet the respective requirements of the positions that they will fill.

2.7.1.02 Responsible people of the field teams who will be handling explosives will be required to hold explosives permits. The EEG project manager will coordinate the acquisition of these permits for the field teams.

2.7.1.03 EEG must coordinate operations prior to mobilization and before demolition operations. Notification must be submitted to:

- United States Federal Aviation Administration
- USCG
- Municipality of Culebra
- Puerto Rico Police
- Culebra Municipal Police
- Culebra Fire Department
- Puerto Rico DNER
- Puerto Rico Environmental Quality Board (EQB)
- FWS
- National Marine Fisheries Service (NMFS)

2.7.1.04 All public announcements will be coordinated through the CESAJ Antilles office.

2.7.1.05 Culebra lacks many resources needed for this project, and shipping of equipment and supplies to the island is laborious. EEG will require use of the ferry and will schedule shipments to occur before and during mobilization.

2.7.1.06 Prior to full mobilization, EEG is required to acquire and set up one magazine in a magazine compound. This will be done in compliance with Puerto Rico regulations and DoD guidance document DoD 6055.9 STD. This task requires installing 10-foot-tall cyclone fencing with three strands of barbed wire across the top. The fence will be located no less than 6.5 feet from the magazine in any direction. EEG will coordinate inspection with the Puerto Rico police.

This must be done prior to shipping explosives to the island. Figure B-2 in Appendix B shows the proposed location of the explosives magazines.

2.7.1.07 The magazine will meet the requirements specified in National Fire Protection Association (NFPA) 780 (Standard for the Installation of Lightning Protection Systems) and will have a grounding rod driven 5 feet into the ground 3 feet from the magazine, and will be connected to the magazine with at least a No. 6 ground strap. EEG will install a 10-foot-tall galvanized fence around the magazine with barbed wire on top. The fence will be located at least 6.5 feet from the magazine on all sides and will not require additional grounding.

2.7.1.08 The EEG project manager will be responsible for ordering explosive materials. Shipment of explosives will be closely coordinated with the beginning of mobilization to reduce potential temporary storage time.

2.7.1.09 Equipment storage may be set up at the office. To provide quick access for field teams, a used 20-foot (or larger) lockable shipping container may be acquired and set up prior to mobilization.

2.7.1.010 EEG will acquire a water pump, a water truck, and associated equipment to wet down the demolition area should demolition be conducted during a drought condition. The SUXOS will be responsible for determining whether the equipment should be employed.

2.7.1.011 EEG will open an account at the local bank to ensure that petty cash is available on the island to pay for incidental supplies and per diems.

2.7.1.012 Other preliminary activities include renting vehicles to transport individuals and/or equipment to the site, plus renting any equipment that may be required on site, including pumps, brush-clearing equipment, or other heavy equipment.

2.7.2 Field Office

2.7.2.01 EEG will establish a field office on Culebra. As office space is at a premium on this small island, the amount of space may be limited to a motel room. The field office will be the base of operations for EEG during field activities. The office will have Internet and telephone access to be used by both EEG and CEHNC personnel. A fax machine, copier, and printer may also be set up at the office. Mail or shipment of packages will be via United States Postal Service.

2.7.2.02 The field staff normally work four 10-hour days, Monday through Thursday (not to exceed 40 hours per week), except for EEG observed holidays. The work hours of the staff may be adjusted by the project manager (such as working five 8-hour days) to better support the field operations. Overtime will not be accrued without the concurrence of the CEHNC contracting officer.

2.8 Location Surveys and Mapping

Refer to Chapter 7 of this plan for detailed information.

2.9 Site Preparation

2.9.01 A licensed Puerto Rico Surveyor will establish and mark the boundaries and grid corners of each work site. The grid corners will be staked and marked with the corner ID. At least four control points consisting of steel rods or rebar will be placed at the investigation area boundaries. Small cays may have one control point instead. Where stakes cannot be driven due to rock, the rock will be painted and the grid corner ID will be noted on the surface. Prior to driving stakes, the area will be checked with electromagnetic detection equipment to ensure that no buried ordnance is in the area.

2.9.02 A vegetation and wetlands survey will be conducted by a qualified tropical botanist prior to the start of the MEC clearance operations. Protected vegetation will be identified and mapped. Additionally, all vegetation removal actions will be coordinated with the responsible environmental resources agencies prior to accomplishing any work in these areas. Protected plants and habitats will be located by GPS and mapped to identify those locations. Protected plants and habitats will remain untouched by site preparation operations prior to coordination with the responsible natural resources agencies. EEG will not perform MEC clearance operations in wetlands without prior coordination with the responsible natural resource agencies.

2.9.1 Tree Removal

2.9.1.01 EEG will identify all native trees that will not be disturbed as part the removal action. Invasive trees, such as mesquite, may be removed from the area. All vegetation removal will be coordinated with the responsible natural resources agencies. Trees and underbrush may be pruned to a height that will allow full area coverage by the geophysical equipment. We believe this height to be up to 12 inches from ground level to provide for unobstructed access to the ground surface.

2.9.1.02 Small trees (less than 2 inches in diameter) may have to be removed to accomplish the tasks in the SOW (Appendix A). EEG will remove larger trees only in cases where MEC is embedded in the tree or caught or suspended in the roots or branches, or to gain access to MEC, in which case the tree will be removed using chain saws. The tree will be sectioned, if necessary, to remove it from the immediate area so as not to interfere with the MEC removal action. If possible, the tree will be trimmed or pruned back instead of removed.

2.9.2 Brush Clearing

2.9.2.01 Selected brush removal, as required, will be conducted either manually or using mechanical equipment, as conditions dictate. Tractors and bulldozers will be used primarily on Cerro Balcon and will not be used on the FWS reserve unless first coordinated with FWS. Most vegetation removal will be conducted on the FWS reserve using hand tools (trimmers). All work on the cays will be closely coordinated through the FWS refuge manager. Brush may be pruned to a height that will allow full area coverage by the geophysical equipment.

2.9.2.02 Brush removal may be necessary to allow the surveyor to establish boundaries and allow UXO teams to complete surface surveys. Brush may be cut using a tractor and brush mower. Power tools such as chain saws, trimmers, and brush cutters may be used in addition to hand tools for this operation. EEG plans to trim and prune only the minimum amount of vegetation on the cays and Culebrita in order to allow our personnel access to the MEC removal areas and to permit full area coverage of the geophysical investigation. If necessary, EEG may trim grasses to no less than 6 inches in height

2.9.2.03 Cut brush will be removed only from the immediate work area so as to not interfere with the MEC removal action. The SUXOS will make a note in his Daily Operations Log of the total grid area cleared of vegetation each day.

2.9.3 Geophysical Equipment Testing

Geophysical techniques for testing are provided in Chapter 6 of this plan.

2.9.4 Surface Sweeps

2.9.4.01 Anomaly avoidance operations will be conducted in support of brush clearing during vegetation clearing on pathways to the magazine complex. The anomaly avoidance team will carefully mark an anomaly-free path to the magazine area.

2.9.4.02 The UXO team leader will record ID data, including item ID nomenclature, offset, and weight on a field copy of the Grid Sweep Log. As a final check to ensure that the item has been removed or destroyed, the UXO Technician III will visually check the item locations at the end of the day to confirm the item removal. The UXO team will dispose of any MEC or munitions debris items that are encountered during the surface clearance operations. All disposal operations will be performed under the direct supervision of the on-site SUXOS and the UXOQC/SO. The UXO team leader will be responsible for locating the item using mapping and/or GPS survey techniques before moving the item and/or its disposal. The disposal location will also be determined by GPS or approved mapping techniques. The Grid Sweep Log will also include a summary of munitions debris weight found on the grid.

2.10 Procedures for Reporting and Disposition of Munitions and Explosives of Concern

2.10.1 Personnel Responsibilities

2.10.1.01 A UXO Technician III will provide a detailed account to the SUXOS of all MEC and munitions debris encountered. This account will include the quantity, type, depth, location, condition, and final disposition of all items located in each grid.

2.10.1.02 All data will be made available to the UXOQC/SO at the end of each work day. The UXOQC/SO will verify the accuracy and completeness of the data. Corrections or clarifications will be made and approved by the initiating UXO Technician III before the data is transferred to the site manager for entry into the site database.

2.10.1.03 A UXO Technician II will be responsible for locating each MEC item. Each item will be located using the proper GPS equipment. If the GPS constellation orientation or beacon is not proper to obtain reliable data, the stakes for the MEC item will be left at the site until the location survey can be completed, or a map will be drawn on the Grid Sweep Log indicating where the item was located.

2.10.1.04 Boundary stakes will not be removed until the EEG UXOQC/SO has performed a QC inspection of the grid and received approval from a CEHNC safety specialist after a quality assurance (QA) completion check.

2.10.2 Safety Precautions

2.10.2.01 If more than one UXO team is working in an area, a minimum safe separation distance of 200 feet or the K50 distance for munitions with greatest fragmentation distance (MGFD) will be maintained between teams. All work will comply with EP 385-1-95a, Basic Safety Concepts and Considerations for Ordnance and Explosives Operations. A copy of this document will be maintained on site.

2.10.2.02 Demolition operations will be conducted according to the standard safety practices and procedures outlined in TM 60A 1-1-31. MEC will be detonated only after positive ID. Demolition shots may be tamped to reduce the possibility of fire, sound attenuation, and fragment dispersal.

2.10.2.03 Demolition operations, if required, will normally take place at the end of each work day. The SUXOS is responsible for determining whether minimum safe conditions exist for conducting operations. If an event such as inclement weather prevents the destruction of any MEC, arrangements will be made to provide security for the site. EEG personnel will provide perimeter security during demolition operations.

2.10.2.04 The MSD for demolition operations is based upon the item being destroyed. Prior to demolition operations, the EEG UXOQC/SO will ensure that safe separation distances are established. Safety distances for intentional detonations are in Subchapter 4.2 of this Work Plan (**Table 4-1** includes the minimum safety distances for intentional detonations of the anticipated MGFD). If an unexpected item is found at the site having a net explosive weight (NEW) greater than the MGFD at the site, the EEG UXOQC/SO will be notified and he will establish a new safe separation distance based on that item. A change to the Explosives Safety Submission (ESS) changing the MGFD to the new item will be initiated and processed through ESS approval channels."

2.10.2.05 All detonations will be conducted according to TM 60A-1-1-31. Detonations will take place only after all unnecessary personnel have left the area and perimeter security has been posted.

2.10.2.06 All charges will be dual primed and initiated. Detonating cord trunk and branch lines will be used to link multiple shots. Jet perforators will be used in the event that venting for the purpose of investigating MPPEH is required.

2.10.2.07 All detonations will normally be tamped with sandbags to reduce the possibility of fire. The local fire department will be notified of pending disposal procedures, and EEG personnel will stand by should firefighting become necessary. Notification of detonations will be made to the applicable local authorities and any other organizations determined to be necessary.

2.10.2.08 During detonations, a designated project vehicle will remain in the safe area to provide emergency egress for the demolition team. The demolition team will be composed of only qualified UXO personnel identified by the SUXOS and will be under the direct supervision of a UXO Technician III who is the demolition supervisor. The demolition team members are the only personnel authorized to use explosives on site.

2.10.2.09 The demolition team, SUXOS, UXOQC/SO, and on-site CEHNC safety specialist are the only personnel other than the demolition team members allowed in the area where charges are being assembled and demolition operations conducted. The demolition team will test the systems and set up the shots in accordance with this Work Plan. The UXOQC/SO or the SUXOS will verify the set-up after the explosives are set. The CEHNC safety specialist may inspect any stage of the operation at his discretion.

2.10.2.010 All demolition materials will be accounted for by the demolition supervisor and reported to the SUXOS. Only the amount of demolition material required to complete each day's operation will be withdrawn from the magazines and transported to the site.

2.10.2.011 After each detonation, the detonation points will be inspected by the UXOQC/SO and the SUXOS to ensure that a misfire, low order, or kick-out has not occurred. The area where demolition operations are being conducted will remain secured until the SUXOS or UXOQC/SO gives the "all clear."

2.10.3 Identification of MEC

2.10.3.01 Every effort will be made to identify and evaluate a suspect MEC item. The UXO team leader will be responsible for the preliminary ID of all MEC. EEG will provide a series of ordnance documents that will be available on site to help identify and evaluate the MEC items found. These will include ordnance data books, Ordata software, and access via the Internet to the Ordata online "International Deminer's Guide to UXO Identification, Recovery, and Disposal." Before any action is performed on an ordnance item, all fuzing will be definitively identified, including fuze type by function and condition (armed or unarmed) and the physical state or condition of the fuze.

2.10.3.02 The UXOQC/SO will review and verify correct and proper ID for all recovered MEC, MPPEH, or MC.

2.10.4 Transportation of Explosives

2.10.4.01 On-site transportation of explosives from the magazines to the demolition location(s) will be by designated vehicle, following the requirements set forth in 49 CFR and DoD 6055.9 STD. Only UXO-qualified personnel may transport explosives. These individuals must have a valid driver’s license and will be instructed on transporting explosives, inspecting and operating vehicles, and emergency response.

2.10.4.02 Vehicles used to transport explosives will have substantially constructed bodies, with no sparking metal exposed in the cargo space, and be equipped with suitable sides and tailgates. Explosives will not be piled to extend over the sides or the end of the vehicle.

2.10.4.03 Vehicles containing explosives will be maintained in good condition and operated at a safe speed and in accordance with all safe operating practices. Vehicles containing explosives will be posted with proper warning signs.

2.10.4.04 Materials or supplies will not be placed on or in the vehicle cargo space containing explosives, detonating cord, or detonators, except for safety fuse and properly secured non-sparking equipment used expressly in the handling of such explosives or detonating cord. Explosives and blasting caps will be transported in separate vehicles. Explosives and blasting caps will be promptly transported without delays in transit. EEG will use day boxes for the transport of explosives. Explosives and blasting caps will be transported at times and over routes that limit exposure to a minimum number of people.

2.10.4.05 Only the necessary attendants will ride on or in vehicles containing explosives or blasting caps. When a vehicle containing explosives or detonators is parked, the brakes will be set, the motor will be shut off, and the vehicle will be blocked securely against rolling. After the vehicle is secured, the blasting cap box and the containers with the explosives will be removed from the cargo area of the vehicle and placed on the ground before any explosives or blasting caps are removed from the containers.

2.10.4.06 The motor vehicle used for transporting explosives will have the following minimum safety equipment:

- Fire extinguishers (two 10A:60B:C dry chemical extinguishers)
- Flame-retardant cover, or metal containers such as Institute of Makers of Explosives (IME) boxes or other suitable metal containers with latching lids and appropriate padding
- Non-metallic bed-liner such as sand bags, dunnage, or wooden box

2.10.5 Safe Holding Areas

Detonations of explosives will be conducted each day that an item is found. A safe holding area therefore will not be required.

2.10.6 Operations in Populated or Sensitive Areas

2.10.6.01 The OOUs to be investigated during implementation of this task order are outside of populated areas; however, at times the transport of explosives may encroach on populated areas. EEG will coordinate transport of explosives through populated areas with the local police, and all vehicles will be properly placarded and all safety precautions will be followed in accordance with this Work Plan.

2.10.6.02 To reduce population exposure to transported explosives, EEG will work with EQB and other responsible agencies to locate the explosives and transportation routes in a manner that will provide the least amount of transport through populated areas. Use of the DNER docks will enable EEG to access the boats for transport of explosives without going through the town.

2.10.6.03 Operations may be conducted in environmentally sensitive areas where sea birds and turtles may nest during certain times of the year. EEG will closely coordinate with the responsible environmental resources agencies to ensure that MEC removal operations will not be conducted in those areas during the nesting seasons. As it is impossible to predict exact dates of nesting behaviors, coordination with the responsible environmental resources agencies will be frequent during the removal action, and schedules will remain flexible to ensure protection of protected sea birds and turtles. Preliminary exclusion dates are provided in the Environmental Protection Plan (Chapter 11).

2.10.6.04 EEG will perform removal operations in a manner to provide maximum safety for the public. To protect the public from exposure to an unintentional detonation during work operations, EEG will maintain an exclusion zone (a distance from work operations where people cannot safely enter) which is equivalent to the maximum fragmentation distance in **Table 4-1** of this Work Plan. EEG will stop work if private citizens or non-essential personnel enter the exclusion zone. During intentional detonations, EEG will be using sandbags over the explosives to prevent fragments from exceeding a distance of 200 feet. This method of blast mitigation has been extensively studied by CEHNC personnel and has been found to be extremely effective for reducing the distance that fragments will travel.

2.10.6.05 EEG will maintain an exclusion zone that will be equivalent to the maximum safety distance identified in **Table 4-1** for work on each of the cays. EEG personnel will be located in boats and will use marine radios and bullhorns to maintain the border of the exclusion zone. If a private boat enters the exclusion zone, EEG personnel will stop work until the boat leaves the area. EEG will coordinate all work operations with local dive shops, boat rental companies, fishermen, and USCG to ensure cooperation on where and when we perform removal operations in an effort to reduce potential effects of downtime.

2.10.6.06 EEG will not be conducting explosive operations below the high-water line on any of the cays; therefore, the blast overpressure will have minimal effect on marine life. Although the potential exists for large bomb detonations, the metal mass that may enter the water will be insignificant over the entire blast area. It should be noted that during the EE/CA and site visits conducted by USACE, no large MEC items were observed at the surface of any of the cays.

2.10.6.07 EEG plans to conduct MEC demolition operations each day that an item of MEC is found. Under most conditions, the MEC item will not remain in place for more than 24 hours after detection; however, if unusual conditions occur (e.g., climate conditions not appropriate for detonation of explosives), EEG will provide security for the item.

2.11 Demolition and Post-Demolition Operations

2.11.1 Responsibilities

2.11.1.1 Senior UXO Supervisor

The SUXOS will be responsible for ensuring that adequate safety and housekeeping measures are taken during all phases of site operation, including demolition activities, and shall visit site demolition locations as deemed necessary to ensure that demolition operations are carried out in a safe, clean, efficient, and economical manner. The SUXOS will complete a Daily Operations Log, which will include demolition data.

2.11.1.2 Demolition Supervisor

Prior to initiation of demolition operations, the SUXOS shall designate one of the team leaders to be the demolition supervisor, who will be responsible for supervising all demolition operations within the area. The demolition activities shall be conducted under the direct control of the demolition supervisor, and the demolition supervisor shall be responsible for training all on-site UXO personnel regarding the nature of the materials handled, the hazards involved, and the precautions necessary. The demolition supervisor will also ensure that the MEC Accountability Log, Demolition Shot Log, Explosives Consumption Certificate, and Explosives Accountability Record (also known as the magazine data card) are properly filled out and accurately depict the demolition events and demolition material consumption for each day's operations. The demolition supervisor shall be present during all demolition operations.

2.11.1.3 UXO Quality Control / Safety Officer

2.11.1.3.01 The UXOQC/SO for the site is responsible for ensuring that all demolition operations are conducted in a safe manner, and is required to be present during all MEC demolition operations. The only exception to this rule is when various types of MEC investigation and remediation operations are being conducted concurrently at multiple sites during periods of continuous demolition operations throughout the day. In such circumstances, a demolition team safety officer will be designated. This individual will report to the UXOQC/SO and assume the UXOQC/SO's responsibilities at the demolition range.

2.11.1.3.02 The UXOQC/SO is also responsible for ensuring the completeness of demolition operations and for weekly inspecting the MEC Accountability Logs, Demolition Shot Logs, Explosives Consumption Certificates, and Explosives Accountability Records. The UXOQC/SO, assisted by demolition team personnel, will inspect each demolition area and an area of up to 250 feet in radius after each demolition shot to ensure there are no kick-outs, hazardous MEC components, or other hazardous items. In addition, the area will be checked with an electromagnetic device, and large metal fragments and any hazardous debris will be removed from the area. Any MEC discovered during the QC check will be properly stored for destruction at a later date. Extreme caution must be exercised when handling MEC that has been exposed to the forces of detonation.

2.11.2 Fire Prevention for Disposal Operations

2.11.2.01 Due to the high fire potential season anticipated at the site, the following procedures will be adhered to on each disposal shot conducted at the site. No fire shall be fought if the fire involves ammunition or explosives, or is supplying heat to ammunition or explosives, or is so large that it cannot be extinguished with the equipment at hand.

- Prior to detonation of items less than 155 mm in diameter, EEG will use sandbags to tamp the blast and mitigate the possible fire hazard. Additionally, the area will be watered down prior to detonations.
- Prior to detonation of items greater than 155 mm in diameter, EEG will tamp using loose fill in accordance with the Buried Explosion Module (BEM) in TP 16 to determine the effective soil thickness.
- The local fire department, police, and emergency management personnel will be notified prior to all detonations. If possible, the fire department should be on scene during demolition operations.
- MEC that is moved for disposal will be taken to a location that will provide the most protection from fires and provide the easiest access for firefighting vehicles if required.
- For MEC that cannot be moved, measures will be taken to carefully plan (prior to detonating shots) fire-suppression accesses and procedures. All disposal and safety personnel will be fully briefed on fire-suppression procedures.
- Immediately after detonation, the demolition supervisor will report status of the disposal site and presence or absence of fires.
- If fire or smoke in the vegetation surrounding the site is present, the demolition team will proceed immediately to the site with field fire-suppression equipment and attempt to suppress any fires present.
- If a fire becomes uncontrollable, emergency notifications to local fire agencies will be made and all field workers will stand by to assist as necessary.

2.11.2.02 The fire prevention goals include:

- Planning effectively for all potential fire suppression obstacles
- Effectively mitigating the disposal shot and surrounding vegetation with water
- Ensuring that prevailing winds will not take potential smoke towards populated areas

- Ensuring that adequate fire suppression equipment is on site
- Maintaining vigilant communications with the local fire department during all disposal operations

2.11.2.03 A centrifugal pump will be used to provide water to the site to wet down the vegetation in the detonation area and reduce the potential of fire. The pump will have a 2-inch or 4-inch diameter intake hose. The pump will be capable of pumping 200 to 400 gallons per minute and it is estimated that the pumping will take less than 10 minutes to fully saturate the 50-foot radius around the detonation point. At Cerro Balcon, the pump will be used in conjunction with a water truck. At Culebrita and the cays, the water will be pumped from the shallow beach area to the site. To reduce the potential for entrainment of little fish into the pump, the end of the intake hose will be fitted with a screen.

2.11.2.04 In lieu of pumped water, a water containment system may be used to mitigate fragmentation from blast effects as detailed in HNC-ED-CS-S-00-3, “Use of Water for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions,” USACE, September 2000.

2.11.3 General Requirements

2.11.3.01 Items determined to be unacceptable to move will be blown in place. All unnecessary personnel will be removed from the area and road guards will be posted, the required local authorities will be notified, and protective works will be instituted prior to demolition. The demolition supervisor will check the area and perform proper mitigation of potential hazards to public property and vegetation using tamping and other engineering controls. These items may be consolidated with items deemed acceptable to move by CEHNC.

2.11.3.02 When destroying multiple items at once, “Procedures for Demolition of Multiple Rounds (Consolidated Shots) on OE Sites” must be used. A copy of this document will be made available on site for the demolition supervisor. EEG will determine MSDs for all demolition operations in accordance with DDESB TP 16. Prior to detonation, all personnel will withdraw beyond the MSD.

2.11.3.03 EEG will conduct an evacuation of all houses within the MSD. At the discretion of CEHNC, arrangements may be made for local temporary accommodations for displaced residents. Evacuees will be permitted to re-enter the area only after the demolition point has been inspected and the "all clear" has been given by the demolition supervisor.

2.11.3.04 Prevailing weather condition information will be obtained from the United States Weather Service and the data logged in the Demolition Shot Log before each shot or round of shots.

2.11.3.05 All shots shall be dual primed.

2.11.3.06 A minimum of 30 seconds will be maintained between each detonation.

2.11.3.07 After each detonation and at the end of each day's operations, munitions debris and related items shall be recovered from the demolition site. Per the SOW, all munitions debris will be disposed of in accordance with munitions debris procedures and all applicable environmental regulations. All collected munitions debris will be 100 percent inspected for absence of explosive materials by UXO personnel and 100 percent re-inspected and certified by the SUXOS before it is turned over to a scrap dealer.

2.11.3.08 When demolition site operations are performed in accordance with the conditions of this contract, the demolition site should not present a noise problem to the surrounding community; however, if a noise complaint is received, the name, address, and telephone number of the complainant should be recorded and reported to the SUXOS, who in turn will report it to the EEG site manager.

2.11.3.09 Before and after each shot, the Demolition Shot Log is to be filled out by the demolition supervisor with all applicable information. This record will be kept with the MEC Accountability Log and reflect each shot.

2.11.4 Environmental Considerations

2.11.4.01 EEG will conduct environmental surveys in the vicinity of the areas to be investigated to identify and map sensitive environmental species. Those areas will be protected from the impact of detonations through the use of barricades, as necessary, based on the size of the areas and the proximity to detonations.

2.11.4.02 The environmental surveys will include a wetlands survey on Isla Culebrita and a protected species and habitat survey on Isla Culebrita, the cays, and Cerro Balcon.

2.11.4.03 During the environmental surveys to the cays, EEG will investigate the routes of access to the cays in order to find the best routes of access that will create the least amount of impact to the marine life in the cays. EEG will conduct all operations in a manner that will provide for the least amount of impact to the marine ecosystems.

2.11.4.04 The results of the surveys will be included in the Work Plan Addendum, which will be reviewed before start of work on the cays.

2.11.4.1 Extent of Impacts from Individual Shots

2.11.4.1.01 The major impacts from individual shots will be a result of the heat, blast pressure, and fragmentation As stated previously, the effects of the heat of the blast will be mitigated by wetting of the surrounding area, and the heat, blast pressure, and fragmentation of the blast will be mitigated using sandbags to tamp shots involving items up to a 155 mm projectile. EEG will tamp items larger than 155 mm using loose fill in accordance with the Buried Explosion Module (BEM) in TP 16.

2.11.4.1.02 As provided in DDESB TP 16: “The nose and tail sections of most munitions will break into a small number of massive fragments moving at velocities up to about 3,000 feet/second (ft/s). The cylindrical body will fracture into many smaller fragments traveling at speeds of up to 8,200 ft/s.” The maximum size of the fragments will be dependent on the design of the individual MEC items. The maximum calculated fragment size for each type of item is included in Appendix G of this Work Plan. It does not include fragments from fuze wells, base plates, lugs, strongbacks, etc. which are frequently larger and travel further (although there are fewer of them). It is suspected that the fragments will vary in size from 0.0006 pound for the 20 mm rounds to 0.9 pound for the 1,000-pound bomb. These metal fragments will be widely dispersed in the area of the site, with higher concentrations in the vicinity of the site.

2.11.4.1.03 The maximum fragmentation distance for the items expected to be found are shown in **Table 4-1** and Appendix G. If items are found during the removal action that are not expected, the fragmentation distance will be calculated for those items. If that distance is greater than the separation distance currently being used, the new distance will become the new separation distance and a change will be initiated to the ESS.

2.11.4.1.04 Any detonation on or below the ground surface will create a crater; therefore, all detonations will result in soil ejecta.

2.11.4.1.05 For humans, the blast can rupture lungs and ears; therefore, non-essential personnel will be kept out of the work area during removal operations. The MSD is the maximum of the maximum fragmentation distance, the blast overpressure distance, or 200 feet. Non-essential personnel are not allowed inside the MSD while work is being performed.

2.11.4.1.06 Minimal impact is possible to the land and marine environments as a result of individual shots. EEG will use the protective actions presented in Subchapter 2.11.4.3 to minimize the impacts of the explosive detonations of MEC.

2.11.4.1.07 The removal action will be conducted inland from the high-water line; therefore, the effects of individual shots on the surrounding reefs will be minimal. Where possible, items that can be safely moved will be moved inland to reduce the impact of shrapnel and debris from the shot into the marine environment.

2.11.4.2 Extent of Impacts for Consolidated Shots

2.11.4.2.01 Tests indicate that the fragmentation characteristics of multiple rounds that are detonated either simultaneously or sympathetically are different than those of single rounds. Large fragments are more numerous for detonations of multiple rounds. Also, the velocity of the leading fragments has been observed to be as much as twice the value for a single item. Therefore, any method used to determine fragment distances produced by multiple round detonations must account for these different fragmentation characteristics.

2.11.4.2.02 The location of consolidated shots will be as far away as possible from the shoreline, critical habitats, and protected species to minimize the impact to the land and marine environments as a result of individual shots. To aid to this end, EEG will use the protective actions presented in Subchapter 2.11.4.3 to minimize the impacts of the explosive detonations of MEC. Appropriate measures as provided in Subchapter 2.11.4.1 will also be conducted.

2.11.4.2.03 The effect of detonating stacks of munitions is to increase the fragment initial velocity by as much as a factor of 2 and to increase the fragment mass by as much as 50 percent. Results of experiments have shown that (per DDESB TP 16) “when detonations involve stacks of munitions, the maximum horizontal range must be increased by 33% to account for interaction effects.”

2.11.4.2.04 The maximum fragmentation characteristics shall be computed in accordance with DDESB TP 16. The maximum fragment range shall be computed using these fragmentation characteristics with a trajectory analysis such as the computer software TRAJ. The maximum fragment range has been calculated for all items expected to be found at the site and the MSD for each area established based on these. Consolidated shots will be done in accordance with "Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites." In accordance with these procedures, the MSD for consolidated shots will not exceed the MSD for the munition with the greatest fragmentation distance (MGFD).

2.11.4.3 Minimization of Impacts

2.11.4.3.01 EEG will make a reasonable attempt to minimize the impacts of the explosive detonations to the environment including sensitive habitats and endangered species. EEG will create a 5-foot buffer around areas containing sensitive species that will not be investigated without approval from CEHNC and coordination with the responsible regulatory agencies. A barricade will be constructed of sandbags to protect the endangered species from fragments of metal and explosives emitted from the shot in areas where endangered plant species or habitats lie in close proximity to the detonations (less than 15 feet). The barricade will be of sufficient height (2 to 4 feet tall) to protect the main part of the vegetation from the blast and direct-line fragmentation.

2.11.4.3.02 EEG will wet down the vegetation prior to performing demolition operations. These steps are described in detail earlier in this section of the Work Plan.

2.11.4.3.03 EEG will tamp shots where items are less than or equal to a 155mm projectile. Tamping will be conducted using sandbags. The thickness of the sandbags is computed and presented in the tables in Appendix G. If items are found that are more hazardous than those included in Appendix G, EEG will contact CEHNC for guidance. Items larger than 155 mm will be covered by loose soil in accordance with TP 16. EEG personnel will be using the BEM model to calculate the maximum fragmentation distance for these items.

2.11.4.3.04 Prior to work, the UXO technicians will receive an orientation concerning expected endangered species at each site, their locations, and protective measures.

2.11.4.3.05 The locations of all items found will be located by GPS coordinates and the condition of each item noted, including signs of damage to the item that may allow leakage of hazardous constituents into the soil.

2.11.4.3.06 EEG will conduct soil sampling both before and after detonations have been conducted. The soil sampling protocol is provided in Appendix E. The results will be compared with the EPA Region 9 Preliminary Remediation Goals. If exceedances of criteria are found, EEG will confer with the CEHNC contracting officer to immediately resample the area to find the extent of the contamination and, if necessary, conduct background sampling for target constituents.

2.11.5 Non-Electrical Demolition Procedures

2.11.5.1 Safety Precautions

2.11.5.1.01 Handle non-electric blasting caps by their open ends, except during attachment to safety fuse and/or the detonating cord.

2.11.5.1.02 Do not confuse the detonating cord with the safety fuse.

2.11.5.1.03 Do not insert anything except the safety fuse or detonating cord into the blasting cap.

2.11.5.1.04 Do not crimp blasting caps by any means except a cap crimper designed for that purpose, and ensure that the fuse-cutting section of the crimper is not used to crimp the cap.

2.11.5.1.05 Handle primed safety fuses with care to avoid contact between blasting caps or between the caps and other hard objects.

2.11.5.1.06 Secure the safety fuse after priming the charge. Do not allow the safety fuse to coil up and contact itself after being ignited.

2.11.5.2 Preparation Procedures

2.11.5.2.01 SUXOS will establish demolition operation times and notify a CEHNC safety specialist and demolition supervisor of the time to start demolition operations.

2.11.5.2.02 The demolition supervisor will conduct a safety and operational briefing for the personnel involved in the operation. At minimum, the briefing will cover items to be disposed of plus safety precautions, task assignments, safe area, safety equipment location, emergency procedures, and plan of action.

2.11.5.2.03 Area guards will be posted.

2.11.5.2.04 Demolition explosives will be brought to the demolition site.

2.11.5.2.05 Unnecessary personnel will withdraw to a safe area.

2.11.5.3 Demolition Set-Up Procedures

2.11.5.3.01 Position and secure donor charge, detonating cord, and perforator/binary explosive to the item to be disposed of.

2.11.5.3.02 Cut and discard at least a 6-inch length from the free end of the safety fuse to be used, which will prevent a misfire caused by moisture absorption.

2.11.5.3.03 Cut off a 36-inch length of safety fuse to check the burning rate. Perform this at least 50 feet downwind from any explosives. Note the time for the fuse to burn. Compute the rate of burn per foot.

2.11.5.3.04 Cut the fuse long enough (but never less than 6 feet) so that the person initiating the charge has enough time, while walking at a normal pace, to reach a safe distance before charge detonation. Attach a fuse igniter to one end of the safety fuse.

2.11.5.3.05 Remove a blasting cap from the container, inspect the open end of the cap, and ensure that no foreign matter is in the cap. If any foreign matter is in the cap, turn the cap upside down and let the matter fall out. If this fails, reject the cap.

2.11.5.3.06 Insert the safety fuse into the open end of the blasting cap. Gently seat the blasting cap firmly against the safety fuse.

2.11.5.3.07 Crimp the cap in place.

2.11.5.3.08 Obtain clearance to prime the donor charge.

2.11.5.3.09 Prime the donor charge, unroll, and secure the safety fuse to prevent recoil after initiation.

2.11.5.3.010 The demolition supervisor will ensure that the area is clear and that all personnel are accounted for, and will obtain clearance from the SUXOS to initiate the charge.

2.11.5.3.011 Upon receiving clearance to initiate the charge, the demolition supervisor will loudly yell, three times: “Fire in the hole!” Team members will function the fuse igniters, note the time, and proceed to the safe area.

2.11.6 Electrical Demolition

2.11.6.1 Electromagnetic Radiation

2.11.6.1.01 Electromagnetic radiation (EMR) sources are not expected in the vicinity of any removal action work site designated in this task order; however, before application of electrical demolition procedures, an EMR survey will be conducted by the UXOQC/SO to determine if any transmitting antennas of radio, radar, or other electromagnetic-generating devices are located in the vicinity. The UXOQC/SO will drive the roads near the site to identify each potential source that may produce strong enough EMR to affect the demolition operations.

2.11.6.1.02 Radio frequency EMR consists of waves of electrical energy. These waves are radiated in a line of sight from the antennas of electronic devices that transmit radio, radar, television, or other communication, including cellular telephones, or other communication or navigation radio frequency signals. The factors to be considered when evaluating the degree of hazard that the radio frequency EMR energy represents are the strength of the field (its power), the frequencies transmitted, the distance from the transmitter antenna to the ordnance, and the amount or type of protection available.

2.11.6.2 Blasting Caps and Safe Distances from EMR Source

Every wire, including a blasting cap lead, by virtue of its length and configuration, is tuned or receptive to a specific frequency. Stretched out, the leads act as a dipole antenna; coiled, they can act as a closed loop antenna. No lead wire configuration is therefore guaranteed to be safe. Electric blasting caps should be kept in a sealed metal container until ready for use. **Table 2-2** provides safety distances for electrical blasting operations.

Table 2-2. Minimum Safe Distances Between Mobile Radio Frequency Transmitters and Electric Blasting Operations

Transmitter Power (Watts)	Safety Distance (in feet)				
	Medium Frequency (MF) To 3.4 MHz Industrial	High Frequency (HF) 28–29.7 MHz Amateur	Very High Frequency (VHF) 35–36 MHz 42–44 MHz 50–64 MHz	Very High Frequency (VHF) 144–148 MHz 150.8–161.6 MHz	Ultra High Frequency (UHF) 450–460 MHz Cellular car phones above 800 MHz
5[1]	30	70	60	20	10
10	40	100	80	30	20
50	90	230	180	70	40
100	120	320	260	100	60
180[2]	170	430	350	130	80
250	200	500	410	160	90
500[3]	280	710	580	220	120
600[4]	300	780	640	240	140
1,000[5]	400	1,010	820	310	180
10,000[6]	1,240	3,200	2,600	990	560

Notes

MHz = megahertz

1 = Citizens band radio (Walkie-Talkie) (26.96 to 27.41 MHz) – minimum safe distance, 5 feet. Double sideband, 4 watts maximum transmitter power – handheld, 5 feet; vehicle-mounted, 65 feet. Single sideband, 12 watts peak envelope power – handheld, 20 feet; vehicle-mounted, 110 feet.

2 = Maximum power for 2-way mobile units in VHF (150.8 to 161.6 MHz range) and for 2-way mobile and fixed-station units in UHF (450 to 460 MHz range).

3 = Maximum power for major VHF 2-way mobile and fixed-station units is 35 to 44 MHz range.

4 = Maximum power for 2-way fixed-station units in VHF (150.8 to 161.6 MHz range).

5 = Maximum power for amateur radio mobile units.

6 = Maximum power for some base stations in 42 to 44 MHz band and 1.6 to 1.8 MHz band.

2.11.6.3 Lightning, Electric Power Lines, and Static Electricity

2.11.6.3.01 Lightning is a hazard to both non-electric and electric blasting caps. A strike or a nearby miss is almost certain to initiate either type of cap and other sensitive explosive elements such as caps in delay detonators. Lightning strikes, even at remote locations, may cause extremely high local earth currents, which may initiate electrical firing circuits. Effects of remote lightning strikes are multiplied by proximity to conducting elements, such as those found in buildings, fences, railroads, bridges, streams, and underground cables or conduit. The only safe procedure is to suspend all blasting activities during an electrical storm and when one is impending. All blasting activities will be suspended when lightning-thunder storms are within 5 miles of the project site. Electrical firing will not be performed within 155 meters of energized power transmission lines. When it is necessary to conduct disposal operations at distances closer than 155 meters to electric power lines, non-electric firing systems will be used or the power lines de-energized.

2.11.6.3.02 Many electric blasting caps have been detonated because they grounded static electricity that was in the air. Static electricity is produced by various causes, among them: dust storms, which have caused a large number of detonations; snow storms, less dangerous but known to have caused premature explosions; and escaping steam, known to have charged the air and detonated electric caps. Enough static electricity to detonate electric caps also can be generated by such sources as moving belts and revolving automobile (truck) tires. Static electricity is an increased hazard when operating in an extremely cold climate or area of low humidity.

2.11.7 Electrical Detonation Procedures

An electric firing system is one in which electricity is used to fire the primary initiating element. An electric impulse supplied from a power source, usually an electric blasting machine, travels through the firing wire and cap lead wires to fire an electric blasting cap. The chief components of the system are the electric blasting cap/electric squibs, firing wire, and the blasting machine. The preparation of the explosive charge for detonation by electrical means is called electric priming.

2.11.7.1 Safety Precautions

2.11.7.1.01 Personnel working with electric blasting caps or other electro-explosive devices will not wear static-producing clothing such as nylon, silk, or synthetic fiber.

2.11.7.1.02 Before making connection with the electric blasting cap, the firing circuit will be continuity tested.

2.11.7.1.03 Electric blasting caps will be connected to the firing circuit before connection to the main initiation charge.

2.11.7.1.04 Electric blasting caps of different manufacturers or types will not be used in the same system.

2.11.7.1.05 The shunt will not be removed from the wires until the individual performing the operation has been grounded.

2.11.7.1.06 Electric blasting caps will be tested for continuity with a galvanometer at least 50 feet downwind from any explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to connect to the firing circuit.

2.11.7.1.07 Do not pull on electrical lead wires of electric blasting caps, detonators, or other electro-explosive devices; a detonation may occur.

2.11.7.1.08 Unroll the legs so that the cap is as far as possible and pointing away from the operator.

2.11.7.1.09 Place the blasting cap in a hole or behind a barricade before removing the shunt and testing for continuity. Make sure the cap does not point toward other personnel or explosives.

2.11.7.1.010 Use only authorized and serviceable testing equipment.

2.11.7.1.011 Do not connect the blasting machine to the firing wires until all pre-firing tests have been completed and until ready in all respects to fire the charge.

2.11.7.1.012 Do not hold the blasting cap directly in the hand when uncoiling leads. Hold the wires approximately 6 inches from the cap. This will minimize injury should the cap explode. The lead wires should be straightened by hand and not thrown, waved, or snapped to loosen the coils.

2.11.7.1.013 Do not remove the shunt from the lead wires of blasting caps except for testing for continuity or actual connection into the firing circuit. The individual removing the shunts should ground himself prior to this operation to prevent accumulated static electricity from firing the blasting cap.

2.11.7.1.014 Keep both ends of the firing wires shorted or twisted together except for testing or firing. Do not connect the blasting caps to the firing circuit unless the power end of the firing circuit lead is shorted.

2.11.7.1.015 Keep all parts of the firing circuit insulated from the ground or other conductors such as bare wires, rails, pipes, or other paths of stray current.

2.11.7.2 Procedures

2.11.7.2.01 Prepare and place all explosive charges.

2.11.7.2.02 After locating a firing position a safe distance away from the charges, lay out the firing wire. (Do not drag firing wire over sand, which may generate a static charge.)

2.11.7.2.03 Test the firing wire by using a blasting galvanometer or test set, after making sure that the testing equipment is functional and after the firing wire has been unreeled. Ensure that the ends are twisted together when not testing.

2.11.7.2.04 Separate firing wire conductors at both ends, and touch those at one end of the galvanometer/test set posts. The needle should not move or the lamp glow; if either occurs, the firing wire has a short circuit.

2.11.7.2.05 Twist the wires together at one end and touch those at the other end to the galvanometer/test set posts. This should cause a wide deflection of the needle or cause the lamp to glow. No movement of the needle indicates a break; a slight movement indicates a point of high resistance, which may be caused by a dirty wire, loose wire connections, or wires with several strands broken off at connections.

2.11.7.2.06 Ground yourself. Test the blasting caps by removing the short circuit shunt. Touch one end of the cap lead wire to one post and other cap lead wire to other post. If galvanometer's needle deflects slightly less than it did when the instrument was tested, the blasting cap is satisfactory; if not, the cap is defective and should not be used. Ensure that the cap lead wires are twisted together when not testing.

2.11.7.2.07 Connect the blasting cap leads to the firing circuit and insert the blasting caps into the main charge or attach to detonating cord leads if the main charge is buried or tamped.

2.11.7.2.08 Depart to the firing point.

2.11.7.2.09 Take cover.

2.11.7.2.010 Obtain a head count.

2.11.7.2.011 Ground yourself. Test the entire circuit after inserting caps into the charges and connecting the charges with the firing wires and moving to firing position. Touch the free ends of the firing wire to test the instrument posts. This should cause a wide deflection of needle or cause the lamp to glow. If the firing circuit is defective, shunt the wire. Then go down range and recheck the circuits. If the splice is found to be defective, replace the wires. If the cap is found to be defective, replace it. Retest the entire circuit to make sure that all breaks have been located before attempting to fire.

2.11.7.2.012 Test the blasting machine before attaching the firing wire. Untwist the ends of the firing wire and fasten them to the posts of the blasting machine.

2.11.7.2.013 Return to the firing point.

2.11.7.2.014 Yell, three times: “Fire in the hole!” Initiate the charge.

2.11.7.2.015 Wait 5 minutes after the detonation.

2.11.7.2.016 Remain in the designated safe area until the SUXOS announces, “All clear.”

2.11.8 Procedures for Detonating Cord Use

2.11.8.01 The detonating cord should be cut using approved crimpers, and only the amount required should be removed from the inventory.

2.11.8.02 When cutting the detonating cord, the task should be performed outside the magazine.

2.11.8.03 For ease of inventory control, measure the detonating cord in 1-foot increments.

2.11.8.04 The detonating cord should not be placed in clothing pockets or around the neck, arm, or waist, and should be transported to the demolition location in either an approved “day box” or a cloth satchel, depending upon the magazine location and proximity to the demolition area.

2.11.8.05 The detonating cord should be placed at least 25 feet away from detonators and demolition materials until ready for use. To ensure consistent safe handling, each classification of demolition material shall be separated by at least 25 feet until ready for use.

2.11.8.06 When ready to “tie in” the detonating cord to either demolition materials or the detonator, the detonating cord will be connected to the demolition material and secured to the

MEC. The detonating cord is then strung out of the hole and secured in place with soil, making sure to leave a 1-foot tail exposed outside the hole.

2.11.8.07 Once the hole is filled, make a loop in the detonating cord that is large enough to accommodate the detonating cord detonator, place the detonator in the loop, and secure it with tape. The explosive end of the detonator will face down the detonating cord toward the demolition material or parallel to the main line.

2.11.8.08 In all cases, make sure that sufficient detonating cord extends out of the hole to allow for ease of detonator attachment and detonator inspection or replacement should a misfire occur.

2.11.8.09 If the detonating cord detonators are electric, they will be checked, tied in to the firing line, and shunted before being taped to the loop. If the detonating cord detonators are non-electric, the time/safety fuse will be prepared with the igniter in place before taping the detonators to the detonating cord loop.

2.11.8.010 In the event that a time/safety fuse is used, and an igniter is not available and a field-expedient initiation system (i.e., matches) is used, do not split the safety fuse until the detonator is taped into the detonating cord loop.

2.11.9 Procedures for Time / Safety Fuse Use

2.11.9.01 Before each daily use, the burn rate for the time/safety fuse must be tested to accurately determine the length of time/safety fuse needed to achieve the minimum burn time of 5 minutes needed to conduct demolition operations. A section of time fuse shall never be less than 6 feet long.

2.11.9.02 To ensure that both ends of the time/safety fuse are moisture-free, use approved crimpers to cut 6 inches off the end of the time/safety fuse roll and place the 6-inch piece in the time/safety fuse container.

2.11.9.03 If quantity allows, accurately measure and cut off a 3-foot-long piece of the time/safety fuse from the roll.

2.11.9.04 Take the 3-foot section out of the magazine and attach a fuse igniter.

2.11.9.05 In a safe location away from demolition materials and MEC, ignite the time/safety fuse, measure the burn time from the point of initiation to the other end, and record the burn time in the demolition supervisor's log book.

2.11.9.06 To measure the burn time, use a watch with a second hand or chronograph.

2.11.9.07 To calculate the burn rate in seconds per foot, divide the total burn time (in seconds) by the length (in feet) of the test fuse.

2.11.9.08 Whenever a time/safety fuse is used for demolition operations, the minimum amount of fuse to be used for each shot will be the amount needed to permit a minimum burn time of 5 minutes. A section of time fuse shall never be less than 6 feet long.

2.11.10 Procedures for Perforator Use

2.11.10.01 Perforators will be used for venting suspected MEC and MC prior to inspection for disposal. The following procedures must be followed when perforators are used.

2.11.10.02 Remove from inventory only the number of perforators required to perform the task.

2.11.10.03 Transport perforators in an approved "day box," cloth satchel, or plastic container, depending upon magazine location and proximity to the demolition operations.

2.11.10.04 Keep perforators stored at the demolition site at least 25 feet away from detonators and demolition materials until ready for use.

2.11.10.05 When ready to use, place the detonating cord through the slot on the perforator and knot the detonating cord, making sure that the detonating cord fits securely and has good continuity with the perforator. Perforators requiring special clips would be attached to the detonation cord, using the clips, in accordance with the manufacturer's directions.

2.11.10.06 Once the detonating cord is secure, place the perforator in the desired location and secure it in place.

2.11.11 Procedures for Binary Explosives Use

2.11.11.01 The following procedures must be followed when binary explosives are used as demolition material.

2.11.11.02 Remove from inventory only the amount of binary explosives required to perform the task.

2.11.11.03 In transporting the solid and liquid components, they need only to be placed apart in the bed of a truck or boat.

2.11.11.04 Do not mix the solid and liquid components until it is certain that the binary explosives will be used, since the resulting mixture is classified by the Department of Transportation as a Class 1.1 explosive.

2.11.11.05 When mixing the solid and liquid components, follow the manufacturer's instructions and wear rubber gloves and goggles. Mix components in an area away from other demolition materials the MEC and, if possible, sheltered from the wind.

2.11.11.06 Once the components have been mixed, it is essential that the lid to the solid bottle is put on securely as soon as possible after mixing to prevent evaporation of the liquid.

2.11.11.07 Attach the detonating cord as recommended by the manufacturer, place the assembled unit in the desired location in the hole, and secure the unit.

2.11.11.08 Proceed from this point as described in Subchapter 2.11.8.

2.11.12 Meteorological Conditions

2.11.12.01 To control the effects of demolition operations and to ensure the safety of site personnel, the following meteorological limitations and requirements shall apply to demolition operations.

2.11.12.02 Demolition operations will not be conducted during electrical storms or thunderstorms.

2.11.12.03 Demolition operations will not be conducted during periods of visibility of less than 1 mile.

2.11.12.04 Demolition shall not be carried out on extremely cloudy days, which are defined as overcast (more than 80 percent cloud cover) with a ceiling of less than 2,000 feet.

2.11.12.05 Demolition operations will not be conducted during any atmospheric inversion condition (low or high altitude).

2.11.12.06 Demolition operations will not be conducted during periods of local air quality advisories.

2.11.12.07 Demolition operations will not be initiated until 30 minutes after sunrise and will be completed at least 30 minutes before sunset.

2.12 Pre-Demolition and Disposal Operations

2.12.1 Operational Briefing

The demolition supervisor will brief all personnel involved in demolition operations in the following areas:

- Type of MEC being destroyed
- Type, placement, and quantity of demolition material being used
- Use of sandbags for mitigation of fragmentation and blast effects
- Method of initiation (electric or non-electric)
- Means of transporting and packaging MEC
- Route to the disposal site
- Equipment being used (e.g., galvanometer, blasting machine, firing wire)
- Misfire procedures
- Fire-prevention procedures
- Post-shot cleanup of demolition area

2.12.2 Safety Briefing

The UXOQC/SO will conduct a safety briefing for all personnel involved in demolition operations on the following topics:

- Care and handling of explosive materials
- Personal hygiene
- Two-man rule and approved exceptions
- Potential trip and fall hazards
- Horseplay on the range
- Staying alert for any explosive hazards on the range

- Location of emergency shelter (if available)
- Parking area for vehicles (vehicles must be positioned for immediate departure, with the keys in the ignition)
- Location of range emergency vehicle (keep engine running)
- Wind direction (to assess potential toxic fumes)
- Location of first aid kit and fire extinguisher
- Route to nearest hospital or emergency aid station
- Type of communications in event of an emergency
- Storage location of demolition materials and MEC awaiting disposal
- Expected endangered species at each site, their locations, and protective measures

2.12.3 Task Assignments

Individuals with assigned tasks will report the completion of the task to the demolition supervisor. Tasks that may be required include:

- Contacting local police and fire personnel, USCG, and Federal Aviation Administration
- Contacting hospital or emergency response personnel if applicable
- Securing all access roads to the range area
- Visually checking range for any unauthorized personnel
- Checking firing wire for continuity and shunt
- Preparing designated pits as required
- Checking continuity of detonators
- Checking time/safety fuse and its burn rate
- Designating a technician to maintain custody of blasting machine or fuse igniters
- Securing detonators in a safe location
- Placing MEC into pit and placing charge in desired location

2.12.4 Preparing Explosive Charge for Initiation

2.12.4.01 Ensure that the firing wire is shunted.

2.12.4.02 Connect the detonator to the firing wire.

2.12.4.03 Isolate or insulate all connections.

2.12.4.04 Place the demolition charge on MEC.

2.12.4.05 Prime the demolition charge.

2.12.4.06 Depart to the firing point (if using non-electrical firing system, obtain head count, pull igniters, and depart to designated safe area).

2.12.4.07 Obtain a head count. Give warning signal, using a bullhorn or siren, 5 minutes before detonation and again at 1 minute before detonation.

2.12.4.08 Yell, three times, “Fire in the hole!” (or an equivalent warning) and take cover.

2.12.4.09 If using an electrical firing system, connect the firing wires to the blasting machine and initiate the charge.

2.12.4.010 Remove the firing wires from the blasting machine and shunt.

2.12.4.011 Remain in a designated safe area until the SUXOS or UXOQC/SO announces, “All clear.” This will be after a post-shot waiting period of 5 minutes and after the SUXOS or UXOQC/SO has inspected the demolition area.

2.13 Post-Demolition and Disposal Procedures

2.13.01 Do not approach a smoking hole or allow personnel out of the designated safe area until cleared to do so.

2.13.02 The SUXOS or UXOQC/SO will check the pit for low orders, kick-outs, and fires prior to giving the “all clear” signal. The SUXOS and UXOQC/SO are trained and qualified in making these checks.

2.13.03 Search the demolition area to remove any large fragmentation.

2.13.04 Backfill the hole as necessary.

2.13.05 Pick up and store all equipment.

2.13.06 Notify police, fire department, and other appropriate agencies that the operation has been completed.

2.13.07 EEG will attempt to restore to original grade any area impacted by detonations. If the amount of restoration is assessed to be extensive, EEG will contact the contracting officer or representative to discuss a restoration approach. Extensive restoration will be coordinated with the responsible environmental resources agencies.

2.14 Misfire Procedures

A thorough check of all equipment, firing wires, and detonators will prevent most misfires; however, if a misfire does occur, the procedures below shall be followed.

2.14.1 Electrical Misfires

2.14.1.01 To prevent electrical misfires, one technician will be responsible for all electrical wiring in the circuit. If a misfire occurs, it must be cleared with extreme caution. The responsible technician will investigate and correct the situation, using the following procedure.

2.14.1.02 Check firing line connections to the blasting machine and make a second attempt to initiate the charge.

2.14.1.03 If unsuccessful, disconnect and connect to another blasting machine (if available) and attempt to initiate the charge.

2.14.1.04 If unsuccessful, wait 30 minutes.

2.14.1.05 After the 30-minute period plus any other predicted delay for any part of the shot has passed, proceed down range to inspect the firing system. A safety observer must watch from a protected area.

2.14.1.06 Remove and disconnect old blasting cap(s), and shunt the wires.

2.14.1.07 Follow normal procedures for effecting initiation of the charge.

2.14.2 Non-Electrical Misfires

2.14.2.01 Working on a non-electrical misfire is the most hazardous of all operations. Occasionally, despite all painstaking efforts, a misfire will occur. Investigation and corrective action should be undertaken only by the technician that placed the charge, using the following procedure.

2.14.2.02 If the charge fails to detonate at the determined time, initiate a wait period of 60 minutes plus the time of the safety fuse (e.g., 60 minutes plus 5-minute safety fuse for a total 65-minute wait period).

2.14.2.03 After the wait period has expired, proceed down range to inspect the firing system. A safety observer must watch from a protected area.

2.14.2.04 Prime the shot with a new non-electrical firing system and install a new fuse igniter.

2.14.2.05 Follow normal procedures for initiation of the charge.

2.14.3 Detonating Cord Misfire

2.14.3.01 If there is no problem with the initiating system, wait the prescribed amount of time and inspect the initiator to the detonating cord connection to make sure that it is properly connected. If the connection is bad, simply attach a new initiator.

2.14.3.02 If the initiator detonated and the detonating cord did not, inspect the detonating cord to make sure that it is a detonating cord and not a time fuze. Also, check to ensure that there is PETN (pentaerythritol tetranitrate) in the detonating cord at the connection to the initiator. It may be necessary to uncover the detonating cord and replace it. If this is the case, it must done carefully to ensure that the demolition charge and the MEC item are not disturbed.

2.14.4 Perforator Misfire

2.14.4.01 The use of perforators is cost-effective and considerably safer than the use of C-4 and many other demolition materials. If the perforator is not initiated properly, it could malfunction. Since the perforator is covered with tamping material, a detonating cord is used as the initiator; therefore, in the event of a misfire, the procedures presented for detonating cord misfire will be followed.

2.14.4.02 If all explosives were initiated but the perforator, one of four things has occurred: (1) the detonating cord grain size was insufficient to initiate the perforator, (2) the detonating cord was dislodged from the perforator when tamping materials were placed, (3) the perforator was defective, or (4) the perforator was moved during the placement of tamping materials.

2.14.4.03 Check to ensure that the grain size of the detonating cord is sufficient (80-grain or greater is the recommended size).

2.14.4.04 If the detonating cord connection to the perforator was the problem, make sure that the next connection is secure (use duct tape if necessary).

2.14.4.05 If it is evident that the perforator was moved, then make sure that it is properly secured for the next shot.

2.14.4.06 If the detonating cord size and connection are sufficient, replace the perforator, leaving the defective one on the shot.

2.15 Recordkeeping Requirement

2.15.01 To document the demolition operations procedures and the completeness of the demolition of MEC, the following recordkeeping requirements shall be met.

2.15.02 The demolition supervisor will ensure the accurate completion of the logs, and the UXOQC/SO will monitor the entries in the logs for completeness, accuracy, and compliance with meteorological conditions.

2.15.03 The demolition supervisor shall enter the appropriate data on the MEC Accountability Log and the Demolition Shot Log to reflect the MEC destroyed, and shall enter the appropriate information on the Explosives Accountability Record (magazine data card), which indicates the demolition materials used to destroy the MEC.

2.15.04 The quantities of MEC recovered must equal the quantities of MEC destroyed or disposed of as munitions debris.

2.15.05 Copies of Alcohol, Tobacco, and Firearms (ATF) license and Puerto Rico police permits must be on site.

2.16 Engineering Controls

In cases where it is appropriate, shots will be tamped with sand-filled bags to mitigate (defeat) the primary fragments and reduce overpressure and noise. Sandbag mitigation must be performed in accordance with HNC-ED-CS-S-98-7. Water may also be used for mitigation in accordance with HNC-ED-CS-S-00-3. Both reports will be available to the demolition supervisor on site. The buried explosion module (BEM), in accordance with DDESB TP 16, will be used for items larger than 155mm in diameter.

2.17 Procedures for Material Potentially Presenting an Explosive Hazard

2.17.01 All items found at a suspected MEC removal site are deemed to be MPPEH or other materials until the team leader identifies it as being MEC, MC, or munitions debris. The item will be carefully inspected and the intact components identified to the point that the item and any associated fuze can be identified. If the item is inert, it will be removed from the site as munitions debris. If the item is determined to be MEC, the item may be vented for further investigation or destroyed in accordance with Subchapter 2.11. Subchapter 2.18 describes the handling, certification, and disposal of munitions debris and range-related debris.

2.17.02 Munitions debris removal is essential to successfully complete surface clearance. Munitions debris must be inspected to determine that it does not contain explosives or explosive residue, and the casing must be vented to prevent a mechanical rupture if the item were placed in a furnace.

2.17.03 All unopened, fully encased munitions debris will be vented and inspected before it is released to a local scrap dealer.

2.17.04 The following four-step process is used for inspecting and classifying inert munitions debris.

1. UXO Technician II inspects the munitions debris for explosive hazards.
2. UXO Technician III inspects it for explosive hazards (now it may be removed from the pad and consolidated with other munitions debris awaiting verification of being free of explosives).
3. The UXOQC/SO inspects 100 percent of the debris for explosive hazards.
4. SUXOS inspects 100 percent of the debris for explosive hazards.

2.17.05 The items are then placed into a 55-gallon drum, which is sealed, tagged, and labeled.

2.18 Munitions Debris and Range Residue Inspection, Certification, and Final Disposition

EEG personnel will be responsible for the inspection, certification, transport, and final disposition of all munitions debris and range-related debris collected during this effort. The following inspection procedures will be in place to ensure that the exterior and interior surfaces of all recovered items are inspected to verify that these items do not present an explosive hazard.

2.18.1 Responsibilities and Procedures

2.18.1.1 UXO Technician I

UXO Technician I will only tentatively identify a located item as MEC, MC, munitions debris, or other.

2.18.1.2 UXO Technician II

- Inspects each item as it is recovered and determine the following:
  —Is the item MEC, MC, munitions debris (MD), or other miscellaneous debris?
  —Does the item contain explosive hazards or other dangerous filler?
  —Does the item require detonation?
  —Does the item require demilitarization or venting of other dangerous fillers?
  —Does the item require draining of engine fluids, illuminating dials, and other visible liquid HTRW materials?
- Segregates items requiring demilitarization or venting procedures from those items ready for certification.
- At the end of the day, weighs the munitions debris collected and records the weight and source grid location on the Grid Sweep Log.

2.18.1.3 UXO Technician III

- Inspects recovered items to determine if they are free of explosive hazards or other dangerous fillers, engine fluids, illuminating dials, and other visible liquid or HTRW materials.
- Supervises detonation of items found to contain explosive hazards or other dangerous fillers and venting or demilitarization procedures.
- Supervises the consolidation and weighing of recovered munitions debris for containerization and sealing.

2.18.1.4 UXO Quality Control / Safety Officer

- Conducts daily audits of the procedures used by UXO teams and individuals for processing munitions debris or range residue.
- Performs inspection of 100 percent of all munitions debris collected from the various teams to ensure that no items with explosive hazards, engine fluids, illuminating dials,

and other visible liquid or HTRW materials are identified as munitions debris, as required for completion of the Requisition and Turn-in Document, DD Form 1348-1A.

- Ensures that the Debris Inventory Logs are complete and correct and that the specific procedures for processing munitions debris and range residue for certification as munitions debris are followed, performed safely, and consistent with applicable regulations and in accordance with the USACE-approved project Work Plan.
- Prior to sealing the drums, verifies that the materials secured are free of explosive hazards.

2.18.1.5 Senior UXO Supervisor

- Responsible for ensuring that the Work Plan and the QCP specify the procedures and responsibilities for processing munitions debris and range residue for final disposition.
- Ensures that a Requisition and Turn-in Document, DD Form 1348-1A, is completed for all munitions debris to be transferred for final disposition.
- Performs inspection of munitions debris to satisfy that the munitions debris or range residue is free from explosive hazards (necessary to complete DD Form 1348-1A).
- Certifies that all munitions debris or range residue is free of explosive hazards, engine fluids, illuminating dials, and other visible liquid or HTRW materials.
- Responsible for ensuring that the inspected materials are secured in closed, labeled, and sealed containers and documented. Each container will be closed and clearly labeled on the outside with a unique ID that will include:

USACE / [*Site name*] / [*Contractor's name*] / [*Sequential container number*, starting with 0001 for the first container] / [*Unique ID number from seal*]

For example, the label for the first container would read:

USACE / Culebra / EEG / 0001 / [*Unique ID number from seal*]

The container will be closed in such a manner that a seal must be broken in order to open the container. The seal will bear the same unique ID number as is placed on the container label. For each container, the following information will be documented: contents, estimated weight of container, location where munitions debris was obtained, name of contractor, names of certifying and verifying individuals, and unique container and seal ID. This information will be submitted in the final report.

2.18.2 Munitions Debris Certification and Verification

2.18.2.01 The SUXOS will ensure that munitions debris generated from removal operations is properly inspected in accordance with the procedures described above in Responsibilities and Procedures. Only qualified UXO personnel will perform these inspections. The UXOQC/SO will first inspect 100 percent of the scrap. The SUXOS will reinspect 100 percent of the scrap prior to certifying that the munitions debris is free of explosive hazards. The CEHNC safety specialist will verify that the munitions debris is free of explosive hazards. In the event that a CEHNC safety specialist is not on site to verify the munitions debris, the UXOQC/SO shall verify the munitions debris in accordance with Attachment A of the SOW (Appendix A).

2.18.2.02 DD Form 1348-1A will be used as certification/verification documentation. Each DD Form 1348-1A must clearly show the typed or printed names of EEG's SUXOS and USACE's OE safety specialist, contractor's name (i.e., EEG), signature of SUXOS, and contractor's home office and field office phone number(s) of the persons certifying and verifying the munitions debris.

2.18.2.03 In addition to the data elements required, the DD Form 1348-1A must clearly indicate the following for scrap metal:

- Basic material content (type of metal, e.g., steel or mixed)
- Estimated weight
- Unique ID of each container and seal
- Location where munitions debris was obtained
- Seal ID, if different from the unique ID of the sealed container

2.18.2.04 The following certification/verification will be entered on each DD Form 1348-1A for turnover of munitions debris and will be signed by the SUXOS and a CEHNC safety specialist:

> This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, is free of explosive hazards, engine fluids, illuminating dials, and other visible liquid or HTRW materials.

2.18.3 Maintaining Chain of Custody and Final Disposition

2.18.3.01 EEG, in coordination with CEHNC, will arrange for maintaining the chain of custody and final disposition of the certified and verified materials. The certified and verified material will be released only to an organization that will:

- Upon receiving the unopened labeled containers, each with its uniquely identified and unbroken seal ensuring a continued chain of custody, and after reviewing and concurring with all of the provided supporting documentation, provide a signed statement that it has received and agrees with the provided documentation that the sealed containers contain no explosive hazards when received. The signed statement will be on company letterhead and will state that the contents of these sealed containers will not be sold, traded, or otherwise given to another party until the contents have been shredded, or flashed, and are identifiable only by their basic content.
- Send to EEG notification and supporting documentation that the contents of the sealed containers have been shredded and are now identifiable only by their basic content.

2.18.3.02 These documents will be incorporated into the final report as documentation supporting the final disposition of this munitions debris.

2.19 Lessons Learned

Procedures for recording, reporting, and implementing lessons learned are included in the QCP (Chapter 10).

3.0 Explosives Management Plan

3.1 General

This plan has been prepared in accordance with the basic contract, local, and federal laws and regulations, including ATFP 5400.7 (2000), DoD regulation 6055.9-STD, applicable Department of Transportation regulations, and Puerto Rico laws and regulations.

3.2 Licenses and Permits

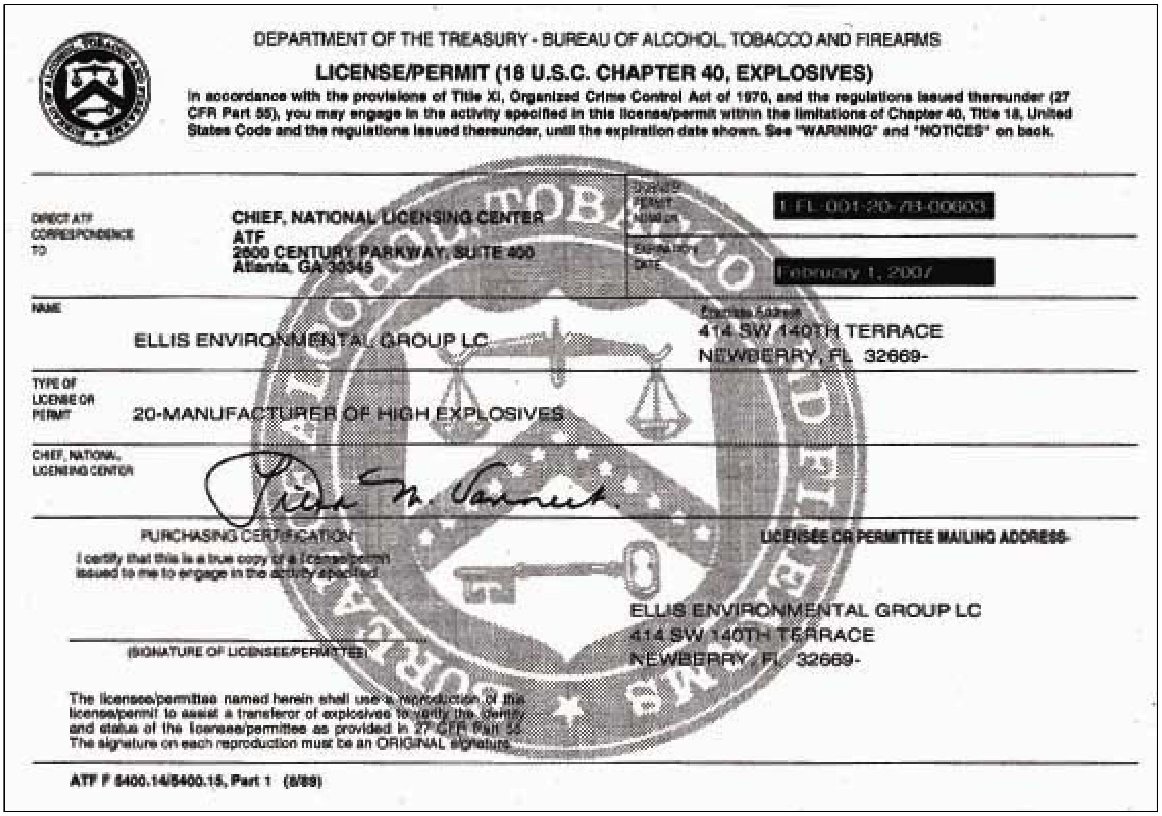
3.2.01 Compliance will be met for all of the requirements of CERCLA, Section 104, and the National Contingency Plan, Sections 300.120(d) and 300.400(e). Puerto Rico requires a permit to import, store, transport, and use explosives in Puerto Rico. The Puerto Rico National Police controls permits but has elected to authorize the shipment, use, and storage of explosives using the same ruling that was used during the EE/CA. An authorization letter will be issued to EEG that will be used instead of a permit. A copy of the Puerto Rico police authorization letter will be posted and available for inspection in the Culebra Island field office. In case the Puerto Rico police do not provide this letter, EEG will obtain the necessary permits and license(s).

3.2.02 Local authorities (i.e., fire department and police) will be notified of the presence and location of storage magazines.

3.2.03 EEG will maintain copies of the following documents on site:

- ATF User of High Explosives license (license number 1-FL-001-20-7B-00603, expiration date: February 1, 2007) (see **Figure 3-1**)
- Letter signed by an authorized official of EEG designating on-site personnel who are authorized to purchase, receive, access, and use explosives
- Puerto Rico explosives permit or letter of authorization

Figure 3-1. ATF License



3.3 Acquisition

3.3.1 Description and Estimated Quantity of Explosives

3.3.1.01 Explosives used for demolition operations will be placed in a 4-foot-square explosives magazine with an attached 18-inch-square cap box, both with ATF-approved locks and hasps. The magazine will be located in the proposed explosives complex (see Map B-2 in Appendix B). The magazine will hold the fuse lighter, fuse, detonating cord, binary explosives, and jet perforators. The cap box will contain the blasting caps. Replacement explosives will be supplied based upon rate of use.

3.3.1.02 The type, amount, class, and NEW of explosive materials that will be stored in the explosives storage area are listed in **Table 3-1**.

Table 3-1. Initial Demolition Explosives

Description	Class / Division	Quantity	Net Explosive Weight	Storage Compatibility Group
Electric blasting caps	1.1	1 case @ 100 per case	Less than 1 pound	B
Jet perforators (shaped charge)	1.4	3 cases @ 40 per case	9.52 pounds	D
Detonating cord (80 grains per foot)	1.1	2,000 feet	22.9 pounds	D
Boosters	1.1	60 each	60 pounds	D

3.3.1.03 Work on the cays will require non-electrical detonation means. EEG will acquire non-electric caps, fuse, and fuse lighters for the cays due to safety distance constraints and size of the cays (see **Table 3-2**).

Table 3-2. Additional Explosives Supply Requirements for the Cays

Description	Class / Division	Quantity	Net Explosive Weight	Storage Compatibility Group
Non-electric blasting caps	1.1	50 each	Less than 1 pound	B
Binary explosives*	3.0 liquid	75 units per case	NA	J
	5.1 solid		NA	
Time fuse	1.4	2,952 feet	44.0 pounds	S
Fuse lighters	1.4	60 each	Less than 1 pound	S
*Due to the difficulty in destroying 20 mm projectiles, EEG will use binary explosives in the consolidated shot for demolition (primarily on Isla Culebrita). Explosive gel (Class 1.1D and Storage Compatibility Group D) may be used as a substitute for binary explosives, as it is readily available on the main island of Culebra. NA = Not applicable prior to mixing of binary components				

3.3.2 Acquisition Source

Explosives for this project will be purchased from commercial vendors.

3.4 Initial Receipt

3.4.1 Procedures for Receipt of Explosives

3.4.1.01 Only the individuals named on EEG's Explosives Authorization Form (see Appendix F) may sign for explosives from the shipper. To ensure that the quantity shipped is the same as the quantity listed on the shipping documents, two EEG personnel will inventory the shipment before signing for it.

3.4.1.02 Upon initial receipt of a shipment of explosives, each container of explosives will be inspected and inventoried by the UXOQC/SO and/or the SUXOS. The contents will be verified to be the quantity and type of explosives ordered and shipped by the manufacturer or supplier, as indicated on the invoice, shipping documents, or bills of lading.

3.4.1.03 All original receipts, shipping documents, or invoices will be retained on site as part of the site's records. Copies of the documentation will be sent to EEG's home office in Newberry, Florida, within three working days upon receipt of the explosive materials. At the completion of the project, the original documents will be put into archive storage and maintained for five years.

3.4.1.04 An Explosives Accountability Record (magazine data card) (included in Appendix F) will be completed for each type of explosives placed in each magazine. The Explosives Accountability Record will be maintained in the explosives magazine and used to indicate the actual quantity on hand of each type of explosives. This information will be appended during weekly inspections and when explosives are removed from or placed into each magazine.

3.4.2 Reconciling Discrepancies

Discrepancies will immediately be reported to the supplier or shipper. If the packages have not been opened and appear to be in their original condition, the discrepancies will be reconciled by immediately contacting the manufacturer or supplier to verify the quantity shipped. In case of a disagreement with the supplier, or if the packages appear to have been tampered with, EEG will immediately notify ATF and complete the forms to report the missing explosives.

3.5 Storage

Explosives used for demolition operations will be placed into an ATF Type 2 portable box magazine. The magazine will be 4 feet square with an attached 18-inch-square cap box. Both the magazine and cap box will have ATF specified locks and hasps. To inhibit access to the magazine, EEG will construct a fence 10 feet high topped with barbed wire around the magazine and will secure the fence and the magazine with high-security locks. The door of the magazine will be equipped with two locks, each having at least five tumblers or five blades and a case-hardened shackle at least 3/8 inch in diameter.

3.5.1 Safety Precautions

3.5.1.01 Smoking, matches, open flames, spark-producing devices, and firearms will not be permitted inside or within 50 feet of the magazine. The land surrounding the magazine will be kept clear of all combustible materials for a distance of at least 25 feet. Combustible materials will not be stored within 50 feet of the magazine.

3.5.1.02 Lightning protection is not required. The magazine does not require dual grounding, in accordance with AR 385-64 (United States Army Explosives Safety Program), Table 6-2. Each magazine will meet the requirements specified in NFPA 780 (Standard for the Installation of Lightning Protection Systems) and will have a grounding rod driven 5 feet into the ground 3 feet from the magazine, and will be connected to the magazine with at least a No .6 ground strap. EEG will install a 10-foot-tall galvanized fence around the magazine with bared wire across the top. The fence will be located at least 6.5 feet from the magazine on all sides and therefore will not require additional grounding.

3.5.2 Key Control

Each magazine will have two sets of keys. The SUXOS and the UXOQC/SO will maintain custody of the keys; however, prior to inspections and demolition operations, the SUXOS may temporarily relinquish his keys to the demolition supervisor.

3.6 Transportation

3.6.1 Transport from Storage Facility

On-site transportation of explosives from the magazines to the demolition location(s) will be accomplished by designated vehicle, following the requirements set forth in 49 CFR and DoD 6055.9 STD. Only UXO-qualified personnel may transport explosives. These individuals must have valid state driver’s licenses and will be instructed on transporting explosives, inspecting and operating vehicles, and emergency response. EQB will be notified of the explosives transportation routes.

3.6.2 Vehicle Requirements

3.6.2.01 Vehicles transporting explosives will be designated and inspected (as follows) to determine that they are suitable and properly equipped for movement of explosives, and inspections and findings will be recorded on the Vehicle Inspection Form (Appendix F):

- Exhaust system is maintained in good mechanical condition and is not exposed to accumulations of oil, grease, or gasoline, and ample clearance is provided from fuel lines and other combustible materials.
- Electrical system is in working order and in good repair.
- Brakes, steering, and other mechanical systems are working and in good condition.
- Fuel tank and piping are secure and not leaking.

3.6.2.02 EEG will properly placard transport vehicles to warn personnel and furnish specific guidance to firefighters and other personnel who may be responding to an emergency involving the vehicle. Transportation on public roads will be in accordance with applicable federal and state regulations, including driver testing and licensing.

3.6.2.03 Other materials or supplies will not be placed on or in the vehicle cargo space containing explosives, detonating cord, or detonators, except for safety fuse and properly secured non-sparking equipment used expressly in the handling of such explosives or detonating cord.

3.6.2.04 Explosives and blasting caps will be transported in separate vehicles.

3.6.2.05 Explosives and blasting caps will be promptly transported without delays in transit.

3.6.2.06 Explosives and blasting caps will be transported at times and over routes that limit exposure to a minimum number of people.

3.6.2.07 Only the necessary attendants will ride on or in vehicles containing explosives or blasting caps.

3.6.2.08 When a vehicle containing explosives or detonators is parked, the brakes will be set, the motor will be shut off, and the vehicle’s tires will be blocked securely against rolling. After the vehicle is secured, the blasting cap box and the containers with the explosives will be removed from the cargo area of the vehicle and placed on the ground before any explosives or blasting caps are removed from the containers.

3.6.2.09 The motor vehicle used for transporting explosives will have the following minimum safety equipment:

- Fire extinguishers (two 10A:60B:C dry chemical extinguishers)
- Flame-retardant cover, or metal containers such as IME boxes or other suitable metal containers with latching lids and appropriate padding
- Non-metallic bed-liner such as sand bags, dunnage, or wooden box

3.6.2.010 Operators of transport vehicles will be EEG employees who have been carefully selected and trained and informed of the explosive hazards involved with the cargo. Prior to movement of explosives-laden vehicles, the cargo will be checked to ensure that containers are loaded, blocked, braced, tied down, or otherwise secured to the vehicle body to prevent movement. Care will be used to select the method to prevent damage to the containers or explosives.

3.6.2.011 The following general safety precautions will be observed during transport operations.

- No person will ride on or in the cargo compartment of a motor vehicle or vessel transporting MEC.
- MEC will not be transported in the passenger compartment of a vehicle or vessel.
- MEC-laden vehicles or vessels will not be left unattended.
- Smoking in vehicles or vessels transporting MEC is prohibited.
- Vehicles or vessels will not be refueled when MEC is on the vehicle or vessel.
- If a trailer is used to transport MEC, safety chains will be fastened between the tow vehicle and trailer.
- MEC will be shipped as close to the center line of a vessel as possible.

3.6.3 Vessel Requirements

Transport of explosives to the cays will require transport by boat or vessel. The same general placard and safety requirements that apply to vehicles will be followed, with the following additions.

- Explosives will be transported as close to the center line of the vessel as possible.
- The blasting caps and other explosives will be separated by at least 25 feet or transported on separate vessels.

- Only the boat captain and two UXO technicians may travel with the explosives on the boat or vessel.

3.6.4 Unplanned Explosions at Sea

The potential of an unplanned explosion at sea is remote, as EEG will follow proper USCG and Department of Transportation precautions for shipping and transport of explosives. If an unplanned detonation does occur, a thorough investigation will be conducted.

3.7 Receipt Documentation

3.7.1 Accountability

3.7.1.01 The UXOQC/SO or the SUXOS will observe all demolition setups and shots to verify that all of the explosives issued were in fact used and consumed. An Explosives Consumption Certificate will be initiated by the SUXOS and presented to the demolition supervisor selected by the SUXOS. The demolition supervisor will issue explosives to members of the demolition team in accordance with the Explosives Consumption Certificate. These forms will be maintained at the EEG field office. As explosive materials are expended, the demolition supervisor will confirm their use on the Explosives Consumption Certificate and annotate the appropriate Explosives Accountability Record (magazine data card) to reflect the quantity used and the quantity remaining.

3.7.1.02 EEG, as the end user of the site explosives, will provide a letter to the contracting officer at the end of the project certifying that the explosives were used for their intended purpose. This document will also be made a part of the final report.

3.7.2 Authorized Personnel

3.7.2.01 An authorizing official of EEG (i.e., chief executive officer, corporate president, or vice president) will sign a letter designating those personnel who are authorized to purchase, receive, access, and use explosives; a copy of this letter will be maintained on site. Authorized personnel are the SUXOS, the UXOQC/SO, the site manager, the project manager, and the team leaders.

3.7.2.02 The Explosives Consumption Certificate (included in Appendix F) certifies that the explosives were expended, as intended, in the MEC disposal process. The demolition team member receiving the explosives from the demolition supervisor will conduct a 100 percent inventory of the material. The quantities annotated on the Explosives Consumption Certificate should match the quantities reflected in the inventory. If these quantities do not match, the demolition supervisor will bring this to the attention of the SUXOS. The demolition supervisor will sign only for the actual quantity of material received, as reflected by the inventory. Receipt documentation will be changed to reflect the proper quantities. This procedure will be conducted for each receipt of explosives materials.

3.7.2.03 The SUXOS will review all explosives tracking forms and maintain the completed forms on a weekly basis to reconcile the quantity of explosives used, and will include these forms as part of the weekly report submitted to the project manager by the site manager.

3.8 Inventory

3.8.1 Physical Inventory Procedures

3.8.1.01 A weekly inventory will be conducted, normally on the last work day of the week. The SUXOS and/or the demolition supervisor will be responsible for performing and documenting the inventory. Each explosive item will be counted. Unbroken cases do not require opening unless there is evidence that the original packaging was disturbed.

3.8.1.02 The Explosives Accountability Record (magazine data card) (see Appendix F) will be completed. Issue and receipt forms and magazine inventories will be reconciled weekly when the magazine contents are inventoried. The SUXOS will indicate in the daily journal that an inventory was conducted that day and will record the results of the inventory.

3.8.2 Reconciliation of Discrepancies

If the Explosives Accountability Record quantities do not match the actual inventory quantities, the UXOQC/SO will perform a second inventory. If the quantities still are not equivalent, the SUXOS and the UXOQC/SO will interview team members to try to identify the discrepancy. If the quantities are still unaccounted for, the SUXOS will follow the procedure in Subchapter 3.9.

3.9 Lost, Stolen, or Unauthorized Use of Explosives

3.9.01 Loss or theft of explosives will be reported as required in 27 CFR Part 55, Subpart C, paragraph 55.30. ATF Form 5400.5 will be completed within 24 hours and forwarded to ATF. A copy of this form is located in Appendix F.

3.9.02 Upon discovering lost, stolen, or unauthorized use of explosives, the demolition supervisor will report the circumstances to the SUXOS. The SUXOS will notify:

- On-site CEHNC representative immediately upon discovery
- Puerto Rico police via telephone at (787) 742-3501 within 24 hours
- ATF, Atlanta area office, via telephone at (404) 769-5130 within 24 hours
- Appropriate local law enforcement authorities in writing within 24 hours
- EEG program manager and project manager via telephone at (352) 332-3888 within one hour of discovery

3.9.03 The EEG project or program manager will notify:

- Contracting officer via telephone at (256) 895-1150 within one hour of discovery
- Contracting officer in writing within 24 hours
- The EQB representative via telephone within 24 hours

3.10 Procedures for Return to Storage

Unused “daily issued” explosives will be returned to the magazine. Explosives will be returned in their original container. The quantities will be indicated on the Explosives Accountability Record (magazine data card), and the Explosives Consumption Certificate will be annotated to indicate the type and quantity of explosives returned to storage.

3.11 Procedures for Disposing of Remaining Explosives

If quantities of explosive materials remain at the end of the project, their disposition will be so noted on the Explosives Accountability Record (magazine data card). If explosives are to be disposed of by detonation, the SUXOS and the UXOQC/SO will inventory all material. The SUXOS and the UXOQC/SO will witness the destruction of the material. A memorandum for the record, signed by the SUXOS and the UXOQC/SO, will document the inventory and destruction of the explosives. This document will become a part of the official site record and will be included in the final report.

3.12 Economic Analysis of Alternatives

3.12.01 At the end of site activities, EEG will perform an economic analysis to determine the most cost-effective method to manage the remaining explosives. This information will be forwarded to the program manager and the CEHNC project manager for authorization. The available alternatives include:

- Returning unopened containers to the commercial distributor or manufacturer for credit
- Transferring stocks to another CEHNC project
- Destroying explosives on site

3.12.02 Experience of previous operations indicates on-site demolition to be the best alternative, as the cost of transporting the explosives is generally greater than the cost of the explosives themselves.

4.0 Explosives Siting Plan

4.1 Safety Criteria

EEG will follow all applicable safety guidance for explosives siting, including:

- TM 60A-1-1-22, EOD Procedures: General EOD Safety Precautions
- EP 385-1-95a, Basic Safety Concepts and Considerations for Ordnance and Explosives Operations
- ER 385-1-95, Safety and Health Requirements for Ordnance and Explosives (OE) Operations
- DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards
- HNC-ED-CS-S-98-7, CEHNC Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions
- Ordnance and Explosives Response (EM 1110-1-4009)
- Procedures for Demolition of Multiple Rounds (Consolidated Shots) on OE Sites, August 1998 (terminology update March 2000)
- HNC-ED-CS-S-00-3, Use of Water for Mitigation of Fragmentation and Blast Effects Due to Detonation of Munitions
- DDESB TP 16, Methodologies for Calculating Primary Fragmentation Characteristics

4.2 Distances and Areas

4.2.1 Munitions Response Sites

In accordance with EM 1110-1-4009, use of the MSD for accidental detonations, defined as the range to no more than one hazardous fragment per 600 square feet, requires written justification, a risk analysis, calculation of this distance by CEHNC-ED-CS-S, and concurrence of CEHNC-OE-S. A list of MEC suspected to be encountered during the field effort is included in **Table 2-1**. The MGFD for each item is included for each site. The MGFD at each of the cays and the associated MSD calculations from DDESB TP 16 are included in **Table 4-1** and in Appendix G of this Work Plan.

Table 4-1. Minimum Separation Distances

Removal Area	MGFD	Unintentional detonations		Intentional detonations		
		Maximum fragmentation distance	To sides & rear using OFB	Without engineering controls	Using sandbag mitigation	Using water mitigation
Cerro Balcon	3-inch Stokes	1,346	200	1,346	200	200[A]
Isla Culebrita	20 mm HEI	318	200	318	200	200
Cayo Botella	6-inch naval projectile	2,510	300[B]	2,510	220	275[A]
Cayo Alcarraza	MK 83 1,000-pound bomb	3,288	NA	3,288	NA	NA
Los Gemelos	MK 83 1,000-pound bomb	3,288	NA	3,288	NA	NA
Cayo Lobo	MK 76 25-pound practice bomb with Mk4 spotting charge	200	200	200	200	200
Cayo del Agua	76 mm HE	1,742	200	1,742	200	200[A]
Cayo Tiburon	MK 83 1,000-pound bomb	3,288	NA	3,288	NA	NA
Cayos Genequi	MK 82 500-pound bomb	3,177	NA	3,177	NA	NA

All distances in feet
A = Requires the use of 1,100-gallon tank for water mitigation for this munition
B = Requires the use of an open front barricade (OFB) for this munition

4.2.2 Planned or Established Demolition Areas

During this removal action, all MEC will be blown in place or consolidated in shots within the work area in which the item is found. Rounds that are unfuzed and acceptable to move may be consolidated with those rounds that are blown in place; therefore, a planned or established demolition area will not be sited.

4.3 Footprint Areas

4.3.1 Blow in Place

4.3.1.01 Blow-in-place operations will be performed when the MEC is unacceptable to be moved. EEG will blow in place any fuzed ordnance or ordnance deemed unacceptable to move.

4.3.1.02 Soil samples will need to be collected at the blow-in-place site before and after disposal procedures. If conditions permit, and with safety considerations as the priority, soil samples will be collected in accordance with the Munitions Constituents Sampling and Analysis Plan (per DID MR-005-10), included as Appendix E.

4.3.2 Collection Points

All MEC found will be disposed of in the site area in which the item is discovered. Collection points for MEC will not be established. MEC items will be blown in place or transported to a consolidated shot point if they are acceptable to be moved.

4.3.3 In-Grid Consolidated Shots

If a situation requires the destruction of consolidated munitions, the procedures will be followed for demolition of multiple rounds (consolidated shots) developed and published by the CEHNC, Procedures for Demolition of Multiple Rounds (Consolidated Shots) on OE Sites, August 1998 (terminology update March 2000).

4.4 Explosives Storage Magazines

4.4.1 Type of Magazines

4.4.1.01 One explosives storage magazine (Type II aboveground portable box) will be secured to store the necessary demolition materials on the work site. The magazine will be located in a secured fenced-in area near Cerro Balcon (see Appendix B, Map B-2). All security and storage requirements of DoD 6055.9 STD will be met. The magazine will include a cap box that will be used to store the blasting caps, less than 1 pound NEW. The main portion of the magazine will be used to store the time fuse, time fuse igniters, detonating cord, jet perforators, boosters, binary explosives, and other explosive materials as identified in Chapter 3 of this plan. The total NEW will not exceed 100 pounds in this magazine. Work on the cays will require the purchase of additional types of explosives per **Table 3-2**. These explosives will be purchased as the amount of explosives is reduced, ensuring that the NEW will not exceed 100 pounds in the magazine at any given time.

4.4.1.02 The quantity-distance (Q-D) is based on a maximum of 100 pounds NEW and determined to be 658 feet from the nearest inhabited building and 395 feet from public traffic, in accordance with DoD 6055.9 STD. Inter-magazine separation distance will be 51 feet should a second magazine be brought in.

4.4.2 Tabulated List of Explosives

For this operation, EEG intends to limit the NEW of the material in storage to less than 100 pounds at any given time. A list of planned explosives to be used is found in **Table 3-1**. Additional types of explosives will be purchased during the field effort to conduct operations on the cays per **Table 3-2**.

4.4.3 Engineering Controls When Quantity-Distance Cannot Be Met

4.4.3.01 Two buildings are in proximity to the Cerro Balcon site. As these buildings are greater than 200 feet from the removal area, tamping will be an adequate method of mitigation. In the event that the investigation site is expanded to the proximity of the buildings, tamping, water, or sandbag barricades may be employed to reduce the fragmentation hazard. Tamping will be used in accordance with HNC-ED-CS-S-98-7, CEHNC Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions. Sandbag mitigation must be performed in accordance with HNC-ED-CS-S-98-7. Water may be used for mitigation in accordance with HNC-ED-CS-S-00-3. Both reports will be available to the demolition supervisor on site. The BEM in accordance with DDESB TP 16 will be used for items larger than 155 mm in diameter. No other engineering controls are anticipated for this site, as no houses are within the present site boundaries.

4.4.3.02 The surface removal operations to be conducted by EEG are non-intrusive; however, there may be minimal excavation due to partially protruding items that may be found at the site. The one house in the valley is presently unoccupied and will not be occupied during intrusive operations; therefore, the use of barricades to protect property and the public is not anticipated.

4.4.4 Site Maps

4.4.4.01 The following site maps are found in Appendix B and include the appropriate Q-D arcs from the amended explosives safety submission and other explosives-related information identified in this plan.

- Map B-1 Culebra Municipality and Investigation Sites
- Map B-2 Cerro Balcon (OOU-3) Grid Layout, Explosives Magazine Location, and Quantity Distance Map
- Map B-3 Culebrita (OOU-4) and Cayo Botella (OOU-5) Grid Layout and Quantity Distance Map
- Map B-4 Cayo Lobo (OOU-5) Grid Layout and Quantity Distance Map

4.4.4.02 The Q-Ds for each of the associated sites are included in **Table 4-1**.

5.0 Geophysical Prove-Out Plan and Report

5.01 This task order is to conduct surface clearance at Cerro Balcon, Isla Culebrita, and several smaller cays located in the Municipality of Culebra. As no intrusive investigation is planned, a geophysical prove-out plan is not required.

5.02 Geophysics will be used to assist with the surface clearance operations. A description of the geophysical methods is included in Chapter 6 of this plan.

6.0 Geophysical Investigation Plan

6.1 Unexploded Ordnance Safety

6.1.01 Geophysical investigation teams will maintain at least a 200-foot separation distance from any other teams for safety while performing their tasks. This avoidance effort will be facilitated by use of electromagnetic detectors to detect surface anomalies in their paths. MEC items that are located on the surface during the geophysical investigation will be reported to the site manager and the SUXOS immediately. The grid coordinates will be recorded for all discovered MEC and other surface features such as craters, bunkers, and military equipment that will assist in demarcating target areas. These data will be incorporated into the project MEC database as surface finds.

6.1.02 The safety of all persons on the project site will be paramount during field operations. A safety and work assignment briefing will be conducted prior to the beginning of each day's field activities. A tailgate safety briefing will address any known hazards of concern for the particular area(s) to be investigated.

6.2 Personnel Responsibilities and Qualifications

6.2.01 During initial field work and surface clearance activities, an individual meeting the UXO Technician II qualifications will accompany the surveyor during the grid layout operations. The UXO Technician II shall conduct visual surveys for surface ordnance and an electromagnetic survey of each specific intrusive activity (e.g., driving stakes) to ensure that the site is anomaly-free. The UXO Technician II will not be required to perform MEC avoidance activities on a full-time basis.

6.2.02 At minimum, personnel using the geophysical field equipment will have completed the OSHA training course for hazardous waste operations and/or the 8-hour refresher. All training will be in accordance with 29 CFR 1910.120, EM 385-1-1 (CEHNC Safety and Health Requirements Manual), and ER 385-1-92 (Safety and Occupational Health Requirements for HTRW and OE Activities). Additionally, the medical surveillance program will be in effect, with personnel (generally UXO Technician I personnel) having received their latest examination within the last 12 months.

6.3 Geophysical Investigation Plan Outline

6.3.1 Site Description

A comprehensive description of the site is included in Chapter 1 of this Work Plan.

6.3.1.1 Geophysical Data Quality Objectives

The geophysical data quality objectives are presented in the following table.

Table 6-1. Geophysical Data Quality Objectives

Step	Description	Application to Remedial Investigation
1	State the problem	Members of the decision team: EEG, CEHNC, CESAJ, Puerto Rico DNER, FWS, Puerto Rico EQB, Municipality of Culebra, EPA, NMFS The goal is to remove surface MEC and MC from 30 acres on the western flank of Cerro Balcon, 82 acres of the northwest end of Isla Culebra, and up to 39.5 acres of additional cays including Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza. The Conceptual Site Model is included as Appendix I.
2	Identify the decision	Decision Statement: Complete the removal of surface MEC in accordance with the EE/CA Action Memorandum based on present land use.
3	Identify inputs to the decision	Inputs to the decision criteria will be provided through: • Initial review of existing data —Review of EE/CA Action Memorandum —Assessment of quantity and types of items to be found —Review of ASRs —Review of area geologic and geographic characteristics • Meetings —Input from stakeholders, residents, and property owners • Site visit —Determine site boundaries for removal action
4	Define study boundaries	The boundaries of the removal action sites are presented in the maps provided in Appendix B.
5	Develop decision rules	Initial action levels include: • Determining applicability of instrumentation to the site-specific conditions • Determining the proper geophysical equipment that will detect the size of MEC expected at the surface • Expanding the boundary of the removal action if MEC is found to exceed the site boundary • Checking the geophysical sensors daily to ensure that they are able to perform per specifications • Removing all surface MEC and performing QA/QC checks before acceptance of a grid

Step	Description	Application to Remedial Investigation
6	Specify limits on decision errors	The precision and accuracy for all positioning data will not exceed ±1 foot. Performance metrics for the removal action include: • OOU-3, Cerro Balcon: No explosive hazards or MEC objects with a width (diameter) or thickness inclusive of MK 23 and larger • OOU-4, Isla Culebrita: No explosive hazards or MEC objects with a width (diameter) or thickness of 20 mm and larger • OOU-5, Adjacent Cays: No explosive hazards or MEC objects with a width (diameter) or thickness of a 3-inch navy gun fired projectile and larger
7	Optimize the design for obtaining data	Assessment of existing and site-derived data must be able to show that all MEC and explosives hazards have been removed from the surface of the site. The data quality objectives will be reviewed and continually evaluated during the removal action to ensure that failures are recognized and corrective actions are implemented as soon as possible. EEG will conduct geophysical sweeps using 4-foot or less survey lane spacing to optimize coverage of the survey grid. EEG will perform operation checks of the instrumentation and operators several times a day (at least at the start of work, at lunch, and at least one test in the afternoon) to ensure the instrument is performing within guidelines (able to detect surface items at the height of instrumentation that is being used). We have chosen an initial two foot target height in order to cut less native vegetation. If the equipment can not detect the items at that height, a lesser target height will be used. The instrument must be able to detect all surface items at that height. The design will be optimized based on the tests to allow the greatest instrument height without losing the ability to detect target items identified in Step 6.

6.3.1.2 Areas To Be Investigated

MEC will be removed from 30 acres on the western flank of Cerro Balcon, 82 acres of the northwest end of Isla Culebrita, and up to 39.5 acres of additional cays, including Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza. Maps B-3 through B-8 (Appendix B) present the locations of these sites. A detailed description of the site and environmental protections are provided in the Environmental Protection Plan (Chapter 11).

6.3.1.3 Past, Current, and Future Use

6.3.1.3.01 OOU-3 is located in the east-central part of Culebra Island on the western slope of the hill named Cerro Balcon. The OOU encompasses approximately 30 acres and extends from the southern part of the San Isidro region of the island to the northern part of the Fraile region. The entire unit is privately owned and used primarily for grazing. Part of the unit is fenced. Access by the public is restricted by the landowner, poor roads, thick vegetation, and the fencing.

At the time of the EE/CA Action Memorandum, the future land use was to remain as grazing; however, present plans are for possible residential land development in this area. Houses have begun to be constructed atop the overlooking hills.

6.3.1.3.02 OOU-4 includes an 82-acre portion of the 266-acre Isla Culebrita, located east of Culebra Island. The island is currently administered by FWS. Past use was minor recreation, and current use is recreation, including swimming, boating, and hiking. The island is accessible only by boat. Access to the island will be coordinated with FWS. Approximately 21,000 people visit the island in a typical year. Several tour guides are permitted access to the island. The north bay of Isla Culebrita is a popular area for boaters and beach visitors. The island will remain under the administration of FWS and may be further developed with hiking trails.

6.3.1.3.03 OOU-5 consists of all the small cays that were identified by the ASR as being part of the Culebra Island naval facility, including Cayo Botella, Cayo Alcarraza, Los Gemelos, Cayo Lobo, Cayo del Agua, Cayo Tiburon, and Cayos Geniqui. All of the islands have rugged terrain and limited beach areas. Most of the small cays are accessible only during calm seas and good weather. Access is currently limited to FWS personnel.

6.3.1.4 Anticipated MEC Type, Composition, and Quantity

6.3.1.4.01 The Cerro Balcon area was used as a mortar practice range. Some fragments of inert 81 mm mortars and one 76 mm mortar were discovered during previous sampling. Historical accounts of finding explosive ordnance items exist. Ordnance would most likely be found in the primary target area but could be found anywhere within the range. The contaminated portion of the mortar range at Cerro Balcon is estimated to comprise 30 acres. Some contamination should be expected anywhere within this area.

6.3.1.4.02 Strafing activity on Isla Culebrita was confined to an 82-acre strafing range located on the western end of the island. Sampling of the strafing range recovered only 20 mm projectiles. Many of these projectiles contained high-explosive incendiary fill. All were recovered from a depth of less than 6 inches.

6.3.1.4.03 All of the other adjacent cays were used as target areas for bombing and rocket fire. No data are available to indicate the relative ordnance intensity on each of the cays. Grids sampled during the EE/CA field investigation had MEC densities ranging from 0 (zero) for all four of the Cayo Lobo sites to 373 MEC items per acre on Cayo Botello.

6.3.1.5 Anticipated Depth

The investigation areas will be surfaced-cleared only. No subsurface clearance will be conducted. Intrusive work might be performed only if a discovered item were partially exposed at the surface.

6.3.1.6 Digital Topographic Maps

6.3.1.6.01 EEG will use aerial photography collected by others to be used as base maps for this investigation. The preparation of digital topographic maps is not part of this SOW. Further description of the geospatial data to be developed during this project is included in Chapter 7 of this plan.

6.3.1.6.02 EEG will obtain elevation and location data of the grid corners from a Puerto Rico-licensed surveyor. The measured elevation data will be referenced to the North American Vertical Datum of 1988 (NAVD88). This data will be entered into the Surfer version 8 software by Golden Software, Inc. to determine the approximate surface area of each grid only.

6.3.1.7 Vegetation

6.3.1.7.01 The vegetation at the Cerro Balcon site is generally thick brush, consisting of mesquite-acacia association and thick, tall grasses. An occasional cactus can be found throughout the area.

6.3.1.7.02 Vegetation on the undeveloped areas of Culebra Island and the larger cays ranges from moderately to extremely dense. These forested areas are thick with undergrowth, including plants with long, sharp thorns (mesquite-acacia). The smaller cays are predominantly rock with sparse or no vegetation other than cactus, thorny brush (mesquite-acacia), and/or tall grasses. The poisonous manzillo tree is present on Flemenco Peninsula and may potentially be found in other areas.

6.3.1.8 Geologic Conditions

Culebra Island and the adjacent cays are underlain by both intrusive and extrusive volcanic rock of Upper Cretaceous Age. Andesite lava and andesite tuff are the most dominant volcanic rocks seen on Culebra and the adjacent cays. Toward the north central portion of Culebra, the tuff and lava contain diorite porphyry inclusions. The volcanic rocks exhibit little or no porosity due to compaction and filling of the pores with quartz and calcite. The volcanic rocks exhibit strong magnetic properties that can affect magnetometer readings.

6.3.1.9 Soil Conditions

Soil is predominately a saprolite (weathered rock), and on average it extends to a maximum depth of approximately 4 feet. Most soils, except along the slopes, are the result of weathering bedrock. The Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate. Igneous rock underlies the saprolite.

6.3.1.10 Shallow Groundwater Conditions

Groundwater is rare at the site and generally found either in a joint in the bedrock or at the soil/bedrock interface. Extensive water-bearing units do not exist in the proposed work areas.

6.3.1.11 Geophysical Conditions

The bedrock and soil at the site are derived from rocks and minerals that have high iron content with associated magnetic properties, which may result in false positive anomalies. In general, the topography is relatively gentle in most of the site areas and ranges to extremely high-angle vertical slopes around Cerro Balcon and Cayo Alcarraza. Thick vegetation may exist in the site areas.

6.3.1.12 Site Utilities

No utilities are in and around the site areas due to the shallow depth to bedrock and the remoteness of the site.

6.3.1.13 Manmade Features Potentially Affecting Geophysical Investigations

Manmade features that will affect geophysical investigations are buildings, sidewalks, and fences; aboveground and underground utilities; sewer covers and culverts; roads and curbs; and buried trash, debris, and artifacts. Fences are installed at property lines at Cerro Balcon. No other manmade features are expected to affect the investigation at any of the other sites.

6.3.1.14 Site-Specific Dynamics

No site-specific dynamic events such as tides, unusually strong winds, or other unusual factors affecting site operations will have a detrimental effect on our instrumentation for surface clearance operations.

6.3.1.15 Site Accessibility and Impediments

Trails to the sites on Cerro Balcon already exist; however, they are overgrown with dense vegetation. The cays are accessible by boat. Access to the cays will be difficult during periods of high waves and wind. On the large cays, the dense vegetation will impede movement toward the interior and across most of the cay.

6.3.1.16 Potential Worker Hazards

Physical hazards expected to be encountered in conducting operations are heat stress, flammable materials, lifting, operation of hand and power tools, inclement weather, uneven or unstable surfaces, sharp objects (e.g., nails and broken glass), trips and falls, excessive noise, dense vegetation, biological hazards, heavy equipment, and explosive hazards. These are further described in the Accident Prevention Plan (Appendix D of this Work Plan).

6.3.2 Geophysical Investigation

Using techniques demonstrated during previous investigations on Culebra, EEG will conduct a surface removal action using visual and electromagnetic methods to locate items at or near the ground surface.

6.3.2.1 Survey Type

Surface clearance surveys will be conducted within 200-by-200-foot grids (based on map projections) along parallel lanes approximately 5 feet wide.

6.3.2.2 Equipment

6.3.2.2.01 EEG will use White’s electromagnetic detectors to supplement visual inspection of the site for MPPEH items. The White’s electromagnetic detector is a hand-portable system that includes transmitter and receiver coils. It is meant for a detect-and-flag-type operation and cannot be used for mapping in its present configuration.

6.3.2.2.02 Should problems occur with the White's detector, alternative detectors may be used upon acceptance by the contracting officer.

6.3.2.3 Procedures

6.3.2.3.01 The site will be gridded into several 200-by-200-foot grids and the corners marked as described in Subchapter 2.9 of this Work Plan. EEG personnel will use the grid system as a starting point for the removal action. Sweep lanes (no wider than 4 feet) will be established in a pattern that will allow UXO personnel optimum sweep rates and coverage. In the event that the vegetation is impenetrable, the procedures described in Subchapter 2.9 will be applied.

6.3.2.3.02 Once an anomaly is located, EEG personnel will visually observe the item to see if it is at the ground surface. If the item is inert, it will be removed from the site. If the item is partly buried (i.e., a portion of the item can be seen from visual inspection of the ground surface), EEG will excavate the item to determine if it is MEC, MC, munitions debris, or other, and to determine the item's condition (i.e., whether it is fuzed). Inert items will be immediately removed from the site. MEC or MC items will be identified, their condition assessed and documented, and the item disposal method will be determined.

6.3.2.3.03 EEG will use a polyvinyl chloride (PVC) flags with the unique identifier number recorded on it with indelible ink to mark the location of a MEC item. Where the ground is impenetrable by the flag, the ground will be spray-painted with high-visibility paint. The locations will be determined by GPS or in some cases by hand measurement. In areas of high concentrations of MEC defined herein as greater than 25 items in a quarter of the grid, the center of the MEC area will be located by GPS, and the number of items found in that area will be identified on the grid map. If the MEC is concentrated in a pile, the pile will be mapped using GPS. This will be necessary primarily at Isla Culebrita, where large quantities of 20 mm rounds are anticipated.

6.3.2.3.04 The location of MEC will be recorded using a Global Positioning System (GPS) and all related information (i.e. depth, size, and condition) will be recorded on a <u>Grid Sweep Log</u>. Small arms (less than 50 caliber), non-hazardous OE scrap, and metallic debris shall be recorded by weight on a per-area basis.

6.3.2.3.05 During the removal action, all MPPEH encountered will be inspected and classified by the Military Munitions Response Program (MMRP), and the data will be formatted and reported in accordance with most recent guidance for SDSFIE. EEG UXO personnel (as discussed in Subchapter 2.18) will measure the weight of scrap collected in each category on a daily basis and place the data on a grid-specific Grid Sweep Log.

6.3.2.3.06 The UXO team leaders will submit all of their completed paperwork to the UXOQCS at the end of each working day. The UXOQCS will review paperwork for completeness and accuracy. After review (and correction, if required), the information on all of the forms will be entered into the site's database.

6.3.2.4 Personnel

All MEC operations will be performed under the direction and supervision of a team leader. During these operations, the UXOQC/SO will closely monitor the operations, strictly enforce safety and adherence to procedures, and ensure that the exclusion area is appropriately evacuated. The team will consist of UXO sweep, UXO Technician I, and UXO Technician II personnel. The SUXOS will periodically work with team personnel. The site manager may also assist getting GPS coordinates of MEC items.

6.3.2.5 Production Rates

Production rates will be affected by vegetation, topography, difficult weather, and access to cays. EEG hopes to average at least 2 acres per day using 2 teams.

6.3.2.6 Data Spatial Density

Not applicable for this type of operation.

6.3.3 Instrument Standardization

Not applicable for this type of operation.

6.3.4 Data Processing, Corrections, and Analysis

Not applicable for this type of operation.

6.3.4.1 Initial Field Processing

Not applicable for this type of operation.

6.3.4.2 Standard Data Analysis

Not applicable for this type of operation.

6.3.4.3 Advanced Data Processing (if applicable)

Not applicable for this type of operation.

6.3.4.4 Anomaly Selection and Decision Criteria

Not applicable for this type of operation.

6.3.5 Dig Sheet Development

Not applicable for this type of operation.

6.3.6 Anomaly Reacquisition

EEG will flag each anomaly or item found. The coordinates will be found either by GPS or by mapping. EEG may measure the distance of the item from two grid corners and place the location on a grid map.

6.3.7 Feedback Process

Not applicable for this type of operation.

6.3.8 Quality Control

6.3.8.01 QC procedures for standard equipment tests and data quality requirements will be performed in accordance with the QC section of this Work Plan (Chapter 10).

6.3.8.02 The electromagnetic detectors will require balancing to remove background effects. Balancing will be conducted in accordance with manufacturer's instructions at the startup of operations each day and prior to conducting equipment operational checks periodically each day to ensure that the balancing does not affect the ability of the instrument to detect a surface item.

6.3.8.03 The frequency of operational checks will be no less than once at the start, once at the end of the day or the completion of the grid. At least one additional check must be performed during one of the breaks during the day and/or when a piece of equipment is suspected of not functioning properly. Both electromagnetic detectors and magnetometers will also undergo a simple "Go"/"No Go" field operational check each day before and after data collection at the frequency stated above. Balancing and selection of sensor mode will be performed at the start up of each electromagnetic device.

6.3.8.04 Additional operational checks of the instrumentation will be performed pursuant to **Table 10-1**.

6.3.8.05 EEG will conduct a test to determine the maximum height at which the instrument can be operated and still reliably detect surface MEC. A blanket affixed with metal items same size or smaller than the target item at the site will be placed with MEC facing down and no evidence of MEC will be seen at the surface. The instrument will be raised off the ground to determine the effective height at which it can reliably and consistently detect each target item. This will become the maximum allowable height for the use of the instrument for that period of operation. The instrument will be operated as close to the surface as possible at all times, not to exceed a height of 2 feet.

6.3.8.06 The results of the operational check, the detection height and the date will be recorded on an Equipment Operational Check Log.

6.3.8.07 Repeatability of response(s) will be checked by performing the check two times per grid.

6.3.9 Corrective Measures

Instruments that do not meet the accuracy of the standard checks will be tagged as inoperable and will be removed from the site until they can be repaired. Indications of operational deficiencies and corrective measures are addressed in Chapter 10.

6.3.10 Records Management

6.3.10.01 The SUXOS will provide the UXOQC/SO a detailed account of all ordnance, ammunition, and explosive items, components, or munitions debris encountered, including quantity, type, depth, condition, and final disposition of all items located in each area. The demolition supervisor will maintain an MEC Accountability Log providing the SUXOS with the details required for the official record.

6.3.10.02 The Daily Operations Log will be kept by the SUXOS or the site manager and will be considered the official log. The site manager shall maintain a spreadsheet or database that records MEC positions, number of like MEC items, nomenclature (if possible), sweep dates, QC/QA dates, coordinates, quantities of munitions debris, range residue, and other related scrap, drum inventory, and other pertinent data. The Daily Operations Log will be part of the information and data for the final report.

6.3.11 Interim Reporting

The site manager will provide the project manager with the data from the Daily Operations Log summarizing the daily activities at the site.

6.3.12 Map Format

Coordinates of all MEC located by the geophysical survey will be recorded using a Trimble Pro XSR GPS or other similar type unit. Coordinates will be in the Universal Transverse Mercator (UTM) Zone 19 projection using the North American Datum of 1927 (Puerto Rico). The maps will be provided in ESRI format.

6.4 Geophysical Investigation Performance Goals

6.4.1 Detection of MEC or Other Munitions

Performance metrics for the detection of MEC are as follows.

- OOU-3, Cerro Balcon – No explosive hazards or MEC objects with a width (diameter) or thickness inclusive of MK 23 and larger
- OOU-4, Isla Culebrita – No explosive hazards or MEC objects with a width (diameter) or thickness of 20 mm and larger
- OOU-5, Adjacent Cays – No explosive hazards or MEC objects with a width (diameter) or thickness of a 3-inch navy gun fired projectile and larger

6.4.2 Horizontal Accuracy

The precision and accuracy for all positioning data will not exceed ±1 foot.

6.4.3 False Positives

False positives will not effect a detect-and-flag operation.

6.5 Geophysical Mapping Data

6.5.1 Monuments of Survey Markers

Monuments and survey markers will not be established during this project. Monuments already exist at Cerro Balcon, Isla Culebrita, Cayo Botella, Cayo Lobo, and Cayo del Agua. Temporary control points will be established at four corners of the investigation area at Cerro Balcon and at accessible points on Isla . The smaller cays will contain only one control point. Each control point will consist of a 3-foot length of number 8 rebar set to ground level.

6.5.2 Geophysical Data Analysis, Field Reacquisition, and Reporting

Not applicable for this type of operation.

6.5.3 Anomaly Reacquisition and Marking

Not applicable for this type of operation.

6.5.4 Anomaly Excavation Reporting

A final report detailing all field activities and including an inventory of all MEC items encountered, their disposition, and their coordinates will be furnished to USACE as required by the SOW. The final report will be provided in accordance with contract requirements.

7.0 Geospatial Information and Electronic Submittals

7.1 General

7.1.01 This chapter describes the incorporation of GIS into the MEC removal action at the Culebra municipality and provides the specific GIS and land survey requirements for the site. All spatial data will conform to the CADD (computer-aided design and drafting) / GIS Technology Center Spatial Data Standards for Facilities Infrastructure and Environment (SDSFIE) GIS data standard as outlined in the task order SOW (Appendix A). Metadata will be created for the core MEC-GIS data layers and will be prepared in accordance with Federal Geographic Data Committee (FGDC) metadata standards.

7.1.02 A Puerto Rico-licensed professional land surveyor will certify all surveying requirements to include all control points, grid corners, transect points, and boundaries as required by the project. The northing and easting coordinates for all control points, grid corners, transect points, and any boundaries or closures will be presented in a certified letter or drawing, along with an electronic submittal of the same to CEHNC upon completion of the field work.

7.1.03 All site boundary surveys will be completed as outlined in the SOW and the basic contract. A UXO technician, who may conduct both a visual and magnetometer survey of the area, will escort the survey crew. No intrusive activity will take place until the UXO technician conducts an electromagnetic survey of the area and concludes that the area is safe.

7.1.04 The locations of individual recovered MEC items will be determined by GPS or by tape measurement to obtain a horizontal accuracy of ±1 foot within the grid, and plotted and identified on the map. Where more than 50 items are located within the area of a quarter of the grid, the location of the concentration extent will be mapped along with the number of items found in that area of the grid.

7.1.1 Accuracy

7.1.1.01 In surveying, horizontal and vertical control of “Class I, Third Order” or better will be established for the network control points. Horizontal control will be based on the metric system and referenced to North American Datum 1927 (Puerto Rico) and the UTM grid system Zone 19. Vertical control, if required, will also be based on the metric system and referenced to NAVD88.

7.1.1.02 The horizontal data will be surveyed to an accuracy of ±1 foot. The elevation data will be accurate to 0.1 foot. EEG personnel will have to collect data for a minimum of 5 minutes at each location to achieve ±1-foot accuracy. EEG will set up a second dual frequency Trimble GPS over a control point in areas where the correction beacon signal cannot be detected. The data collected by the second device will be used to process the Pro XR data.

7.1.2 Geographic Information System Incorporation

Spatial data (i.e., grid corners, MEC locations, control points, etc.) generated for this removal action are to be provided in ESRI (ArcView/ArcInfo) format during the project, and in neutral, non-proprietary Spatial Data Transfer Standard (SDTS) format at the completion of the project. Supporting tabular data may be provided in either Microsoft Excel or Microsoft Access database format. The final submittal in electronic format will contain all required project files and layout files for all plates, figures, and drawings conveyed in the appropriate final report. The government will provide EEG with geospatial aerial photography data to include orthomosaics, geo-referenced TIF files, MrSID files, Metadata files, etc.

7.1.3 Plotting

7.1.3.01 All of the control points established at the site will be plotted at the appropriate coordinate points on reproducible electronic or hard-copy media for production of planimetric or topographic maps at scales appropriate for the parcel size being described:

- Parcels less than 10 acres will be plotted at 1:200.
- Parcels 10 to 100 acres will be plotted at 1:600 (1 inch = 50 feet).
- Parcels larger than 100 acres will be plotted at 1:2400 (1 inch = 200 feet).

7.1.3.02 Area maps will be provided for parcels of 100 acres and will show sheet breakdown for subsequent sheets required for the set.

7.1.4 Mapping

7.1.4.01 An overall planimetric design file will be created and will be digitized into a MicroStation DGN file at an elevation of zero. Each sheet will be a standard metric A-1 size drawing, which is 841 mm by 594 mm (33.1 inches by 23.4 inches). Each sheet will also have a standard border; revision block; title block; complete index sheet layout; bar scale; legend; grid lines or grid tic layout in meters; and a true north, a magnetic north, and a grid north arrow, with their differences shown in degrees, minutes, and seconds. Each sheet will be plotted at the horizontal scales required. The contractor’s logo will not dominate the title block and sheet border. The standard A-1 sheet size title block and border define the text size, location, and format.

7.1.4.02 The location, ID, coordinates, and elevations of all the control points recovered and/or established at the site will be plotted on reproducible media for planimetric or topographic maps. The figure scales will be such that the grids and MEC items found at the site are easily identified. Each control point will be identified on the map by its name and number and the final adjusted horizontal coordinates and elevations (to the closest 0.001 meter and 0.01 foot, respectively). Grid lines or tic marks at systematic intervals with their grid values will be shown on the edges of the map. Also, a legend showing the standard symbols used for the mapping and a map index showing the site in relationship to all other sites within the boundary lines of the project area will be shown.

7.2 Digital Design Data

7.2.01 The digital data set and all supporting files/data will be provided in an attached cell library. EEG will also provide a fully documented data manual with all production and work files. The manual will include all specific information enabling an outsider to be able to recreate all products and determine the location, names, structures, and association of the data such as layer description, weights, colors, symbols, referencing of files, etc. The manual will also be included as an ASCII file titled READ.ME that is included with all distributed digital data.

7.2.02 Until proven compatible with the CEHNC graphics system, no digital data will be acceptable. All revisions that are required to ensure compatibility with the CEHNC graphics system will be made at the EEG’s own expense.

7.3 Computer Files and Digital Data Sets

7.3.01 All final document files (e.g., reports and associated figures and tables) generated will be furnished to CEHNC in IBM PC-compatible Microsoft Office 97 or higher software and in Adobe Portable Document Format (PDF). All final text files will be submitted in Microsoft Word 98 or higher with spreadsheets in Excel. Products will be suitable for viewing, without modification, on the Internet. Freeware versions of Adobe Acrobat Reader, Netscape, and Microsoft Internet Explorer, as appropriate, will accompany the document files on compact disk

(CD-ROM) so that the user can use the CD to either install the programs and documents on a machine, or use the CD in a stand-alone mode to view the document files.

7.3.02 All in-progress and fielded GIS data, design drawings, survey data, relational databases, geophysical data, and other related data may be required to be available on line to the government by HTTP or FTP download or by Web-based GIS queries as specified for the project. All final GIS data generated will be submitted in non-proprietary SDTS format at the close of the project, as well as in the Micro Station (MGE) format. All formal GIS data submittals will be made on PC CD-ROM. Each submittal will be accompanied by a freeware viewer application appropriate for reviewing the proprietary formatted GIS data as well as by instructions for loading the data and viewer application.

8.0 Work, Data, and Cost Management Plan

This Work, Data, and Cost Management Plan has been prepared by EEG to provide guidance for the effective management of budgeted funds and manpower necessary to complete tasks set forth in the SOW in a cost-effective, timely manner. Tasks to be performed under this project include:

- Task 1 – Project Preparation and Planning
- Task 2 – Work Plan
- Task 3 – Perform Community Relations
- Task 4 – Removal Action
- Task 5 – Geospatial Data
- Task 6 – Final Report
- Task 7 – Environmental Sampling

8.1 Project Management Approach

EEG has the lead responsibility for all service areas under each task order, including team integration, engineering, program management, data management, GIS, cost control, program safety, QC, community relations, and subcontractor selection and management. EEG will coordinate all activities with CEHNC.

8.1.1 Project Management

The EEG project manager will track the progress of the project using Microsoft Project, Access (database), and Excel (spreadsheets), and other project management tools. The project manager will be the single point of contact for technical and financial issues and will always know the work and cost status of his task order.

8.1.2 Program Management

The program manager performs periodic projects reviews to assess contract compliance to budget and schedule. He is the point of contact for CEHNC regarding contract issues.

8.1.3 Site Management

The site manager is responsible for the day-to-day management and execution of the project field operations and personnel. Daily duties include technical review and scheduling, coordinating and monitoring of subcontractor and EEG field activities, and enforcing compliance with all work plans. The site manager will submit site records of work progress to the project manager on a daily basis and update project management files, including work performed and cost data.

8.1.4 Overall Approach

8.1.4.1 Work Plan

The Work Plan was developed and reviewed by EEG personnel familiar with the specific project objectives, the SOW, and contract requirements. The Work Plan will be reviewed and approved by CEHNC prior to execution of the applicable field tasks. A copy of the Work Plan will be kept on site and reviewed during field work. Supplemental plans have been developed to provide detailed direction of every aspect of the project.

8.1.4.2 Community Relations

EEG will provide support to community relations activities as directed by the CEHNC project manager with input from the CESAJ project manager and the TPP process.

8.1.4.3 MEC Removal Action

The EEG project team will conduct surface MEC investigation based on visual and electromagnetic-assisted survey techniques. MEC removal records will be forwarded to EEG's Newberry, Florida, office on a daily basis. These data will be used to document the progress of the field effort and update progress schedules and financial tracking. EEG will supply weekly reports to CEHNC as required by the contract.

8.1.4.4 Quality Control

A Technical Management Plan (Chapter 2) and a QCP (Chapter 10) have been prepared for this project describing the tasks that will be performed and quality management procedures to be followed. QA will be performed by personnel listed in the CEHNC project Quality Assurance Surveillance Plan.

8.1.4.5 Environmental Sampling

EEG will collect pre- and post-detonation composite samples at detonation areas or where suspected MEC is identified in any area that will result in a blow-in-place. Sampling will be conducted to ensure that contamination caused by MEC destruction activities does not remain at the work sites. For detailed information related to environmental sampling, see the Munitions Constituents Sampling and Analysis Plan (Appendix E).

8.1.4.6 Final Removal Report

Upon conclusion of the field work, the EEG project manager will compile the field data into pre-draft, draft, and final reports. The EEG project manager, an editorial reviewer, and an independent technical reviewer will review the reports before submittal.

8.1.5 Controls to Ensure Timely Work Under Established Parameters

EEG field personnel will submit daily reports to the project manager during all field work efforts. The project manager will review all daily reports. Completed reports will be provided to a CEHNC safety specialist at the site. Based on the projected work schedule, the project manager will update the schedule to ensure that schedule and budget goals are being met.

8.1.6 Subcontractor Management and Integration Procedures

8.1.6.01 Subcontractor support will be used by EEG for surveying and mapping and sample analysis. Other subcontractors may be used as appropriate to add support to the vegetation clearance activities. EEG will impose progressive disciplinary steps up to and including dismissal in the event of substandard performance. Any violation of safety regulations justifies immediate removal from the site.

8.1.6.02 EEG will utilize the following subcontractors:

- To be determined– Surveying and mapping
- STL Chicago – Sample analysis
- Timberline – Vegetation clearance

8.1.6.03 Materials and transportation suppliers will include:

- Ferreteria Gonzalez – Hardware and supplies
- Jerry’s Jeeps – Transportation
- Carlos Jeep Rental – Transportation and heavy equipment

8.2 Project Schedule

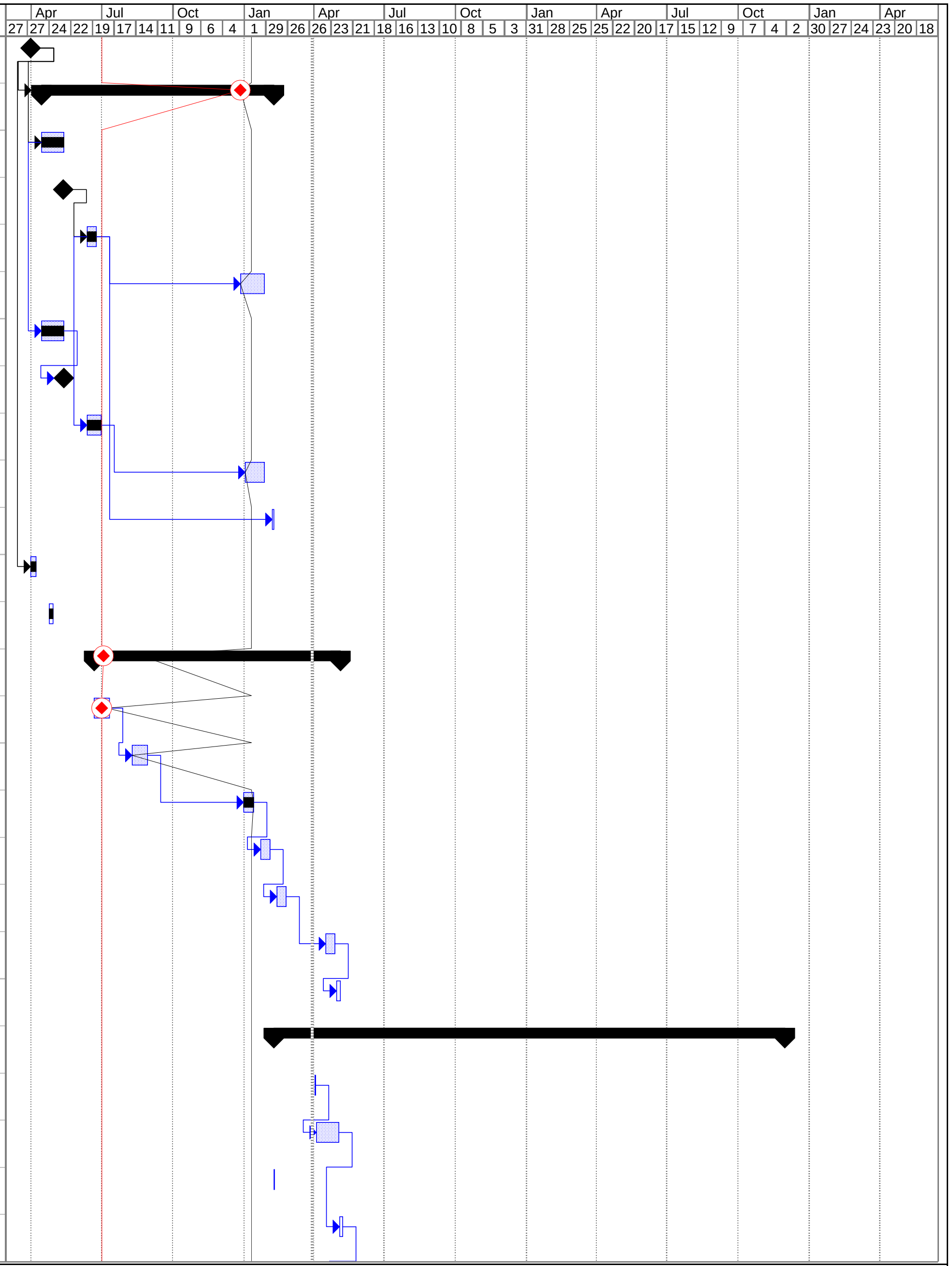
EEG uses Microsoft Project to compile and track scheduled project activities. The EEG project manager will monitor and report all tracking information to the CEHNC project manager on a monthly basis and during field work on a weekly basis. The planned schedule is provided in **Figure 8-1**. The schedule will remain flexible and will be closely coordinated with the responsible environmental resources agencies to ensure no impact to nesting birds and turtles.

8.2.1 Milestones for Task Deliverables

The following milestones were established by EEG during the planning phase of the project and are subject to change:

Draft Website Page Design	03 February 2006
Draft Final Website Design	24 February 2006
Final Work Plan	27 January 2006
Culebra Public Meeting	09 February 2006
Final Website Design	17 March 2006
Website Startup	01 May 2006
Mobilize to Culebra	05 May 2006
Demobilize	07 July 2006
Remobilize to Culebra	28 August 2006
Demobilize	06 April 2007
Remobilize to Culebra	22 October 2007
Demobilize	30 November 2007
Pre-Draft Removal Action Report	28 December 2007
Draft Removal Action Report	12 February 2008
Data Certification	21 December 2007
Data Validation	01 January 2008
Pre-Draft Sampling Report	07 February 2008
Pre-Draft Quality Control Summary Report	18 January 2008
Final Removal Action Report	01 April 2008
Draft Sampling Report	14 March 2008
Final Quality Control Summary Report	31 March 2008
Final Sampling Report	17 April 2008

ID	Task Name	Duration	Start	Finish	Predecessors
1	Notice to Proceed	0 days	Fri 4/1/05	Fri 4/1/05	
2	**Field Effort Planning**	**214 days**	**Fri 4/15/05**	**Wed 2/8/06**	**1**
3	Pre-Draft Work Plan	21 days	Fri 4/15/05	Fri 5/13/05	1
4	Submit Pre-Draft Work Plan	0 days	Fri 5/13/05	Fri 5/13/05	
5	Submit Draft Work Plan	10 days	Mon 6/13/05	Fri 6/24/05	4FS+21 days
6	Submit Final Work Plan	23 days	Wed 12/28/05	Fri 1/27/06	5FS+132 days
7	Pre Draft Sampling and Analysis Plan	21 days	Fri 4/15/05	Fri 5/13/05	3SS
8	Submit Pre-Draft Sampling and Analysis Plan	0 days	Fri 5/13/05	Fri 5/13/05	7
9	Draft Sampling and Analysis Plan	14 days	Mon 6/13/05	Thu 6/30/05	5SS
10	Final Sampling and Analysis Plan	19 days	Tue 1/3/06	Fri 1/27/06	9FS+132 days
11	Stakeholders Meeting	2 days	Tue 2/7/06	Wed 2/8/06	5FS+122 days
12	Proposed Schedule	5 days	Fri 4/1/05	Thu 4/7/05	1
13	Site Visit (optional)	5 days	Mon 4/25/05	Fri 4/29/05	
14	**Community Relations**	**228 days**	**Wed 6/22/05**	**Fri 5/5/06**	
15	Submit Draft Final Public Invlvement Plan	14 days	Wed 6/22/05	Mon 7/11/05	
16	Submit Final Public Involvement Plan	14 days	Wed 8/10/05	Mon 8/29/05	15FS+21 days
17	Draft Initial Website Design Flowchart	10 days	Sun 1/1/06	Fri 1/13/06	16
18	Draft Website Page Design	10 days	Mon 1/23/06	Fri 2/3/06	17FS+5 days
19	Draft Final Website Design	10 days	Mon 2/13/06	Fri 2/24/06	18FS+5 days
20	Final Website Design	10 days	Mon 4/17/06	Fri 4/28/06	19FS+5 days
21	Website Start Up	5 days	Mon 5/1/06	Fri 5/5/06	20
22	**Field Effort**	**472 days**	**Thu 2/9/06**	**Fri 11/30/07**	
23	Notice to Proceed to Field	1 day	Mon 4/3/06	Mon 4/3/06	
24	Preparation for field effort	21 days	Wed 4/5/06	Wed 5/3/06	23FS+1 day
25	Public Meeting - Culebra	1 day	Thu 2/9/06	Thu 2/9/06	
26	Mobilize to Culebra	2 days	Fri 5/5/06	Mon 5/8/06	24FS+1 day

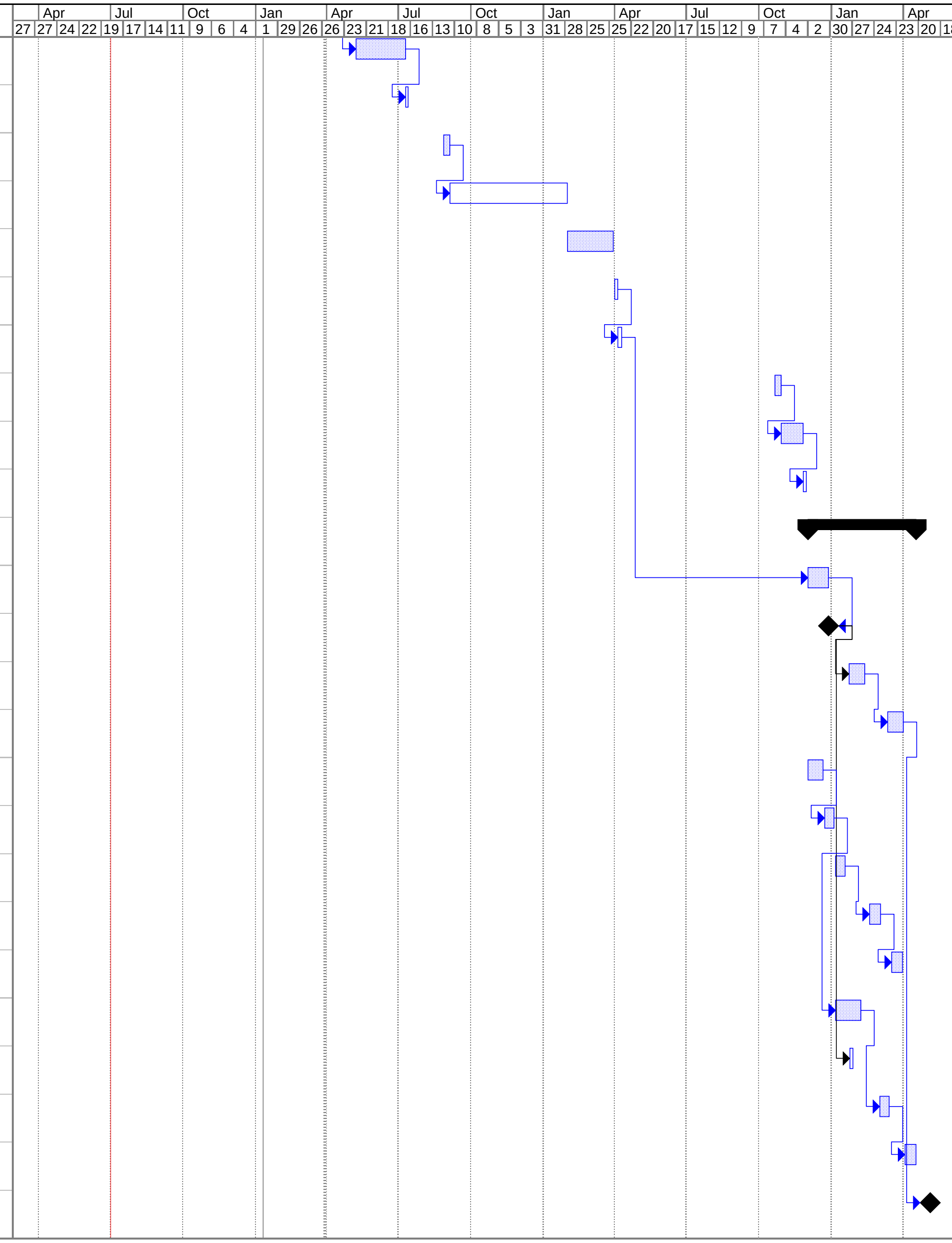


Project: Culebra Task Order 0001-98
Date: Wed 3/29/06

Task | Summary | Rolled Up Progress | Project Summary
Progress | Rolled Up Task | Split | Group By Summary
Milestone | Rolled Up Milestone | External Tasks | Deadline

Figure 8-1. Project Schedule
Page 1 of 2

ID	Task Name	Duration	Start	Finish	Predecessors
27	Surface Clearance Operations - Cerro Balcon	45 days	Tue 5/9/06	Mon 7/10/06	26
28	Demobilize	3 days	Tue 7/11/06	Thu 7/13/06	27
29	Remobilize	6 days	Mon 8/28/06	Mon 9/4/06	
30	Surface Clearance Operations - Culebrita	107 days	Tue 9/5/06	Wed 1/31/07	29
31	Surface Clearance - Other Cays	42 days	Thu 2/1/07	Fri 3/30/07	
32	Scrap Disposal	4 days	Mon 4/2/07	Thu 4/5/07	
33	Demobilize	3 days	Fri 4/6/07	Tue 4/10/07	32
34	Remobilize	6 days	Mon 10/22/07	Mon 10/29/07	
35	Surface Clearance - Other Cays	20 days	Tue 10/30/07	Mon 11/26/07	34
36	Demobilize	4 days	Tue 11/27/07	Fri 11/30/07	35
37	**Report**	**99 days**	**Mon 12/3/07**	**Thu 4/17/08**	
38	Pre-Draft Removal Action Report	20 days	Mon 12/3/07	Fri 12/28/07	33FS-10 days
39	Submit Pre-Draft Report	0 days	Fri 12/28/07	Fri 12/28/07	38FF
40	Submit Draft Removal Action Report	14 days	Thu 1/24/08	Tue 2/12/08	39FS+18 days
41	Final Removal Action Report	14 days	Thu 3/13/08	Tue 4/1/08	40FS+21 days
42	Data Certification	15 days	Mon 12/3/07	Fri 12/21/07	
43	Data Validation	10 days	Mon 12/24/07	Fri 1/4/08	42
44	Pre-Draft QCSR	10 days	Mon 1/7/08	Fri 1/18/08	
45	Draft QCSR	10 days	Tue 2/19/08	Mon 3/3/08	44FS+21 days
46	Final QCSR	10 days	Tue 3/18/08	Mon 3/31/08	45FS+10 days
47	Pre- Draft Sampling Report	24 days	Mon 1/7/08	Thu 2/7/08	43
48	Meeting in Huntsville	2 days	Fri 1/25/08	Mon 1/28/08	39FS+19 days
49	Draft Sampling Report	10 days	Mon 3/3/08	Fri 3/14/08	47FS+14 days
50	Final Sampling Report	10 days	Fri 4/4/08	Thu 4/17/08	49FS+14 days
51	Project Closeout	0 days	Tue 5/6/08	Tue 5/6/08	41FS+10 days



Project: Culebra Task Order 0001-98
Date: Wed 3/29/06

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary | Group By Summary | Deadline

Figure 8-1. Project Schedule
Page 2 of 2

8.3 Cost Control and Tracking Methodology

8.3.1 Costing

8.3.1.01 Several tasks provided in the SOW are time-and-materials tasks. These include community relations, removal action, environmental sampling, and final report for environmental sampling. Cost control and tracking is required for these tasks only.

8.3.1.02 EEG uses the Deltek software accounting system to track project costs and invoicing. Deltek is designed to control costs based on real-time budget and cost data. The system accumulates direct material, direct labor, and other direct costs, and segregates direct, indirect, and unallowable costs. The system is reconciled and controlled by a general ledger and is periodically inspected by the Defense Contract Audit Agency for completeness and accuracy.

8.3.1.03 The EEG project manager reviews this information on a regular basis to anticipate and prevent cost overruns and schedule delays.

8.3.1.04 EEG will also provide real-time cost tracking while working in the field. By frequent review of actual costs and performance progress in comparison with budgets and schedules, potential costs and/or schedule variances can be identified early and corrective action can be implemented. These monitoring procedures will be applied to this contract on a weekly basis to ensure accurate reporting and cost controls.

8.3.2 Billing

8.3.2.01 EEG uses the Deltek cost accounting system to manage financial information for all of its clients. Subcontractor invoices and employee work records generally are input daily to maintain a real-time snapshot of the project's budget. An on-site real-time cost tracking system will be implemented to ensure that costs are tracked effectively and will provide a second check for the project manager to ensure that all costs are properly accounted for in the Deltek system. Recurring Deliverables

8.3.2.02 **Table 8-1** summarizes the list of recurring deliverables associated with this project.

Table 8-1. Recurring Deliverables

Deliverable	Reference	Scheduled Due Date
Quality Control Reports	DID MR-005-12	Daily, no later than the first working day following the report day
Weekly status reports	DID MR-085.01, SOW 4.12.7	Weekly, no later than the first working day of the following week during field work
Monthly status reports	DID MR-085.01, SOW 4.12.6	Monthly, no later than the 10th of the following month
Meeting minutes	DID MR-045.01, SOW 4.12.4	No later than 10 days after each meeting
Exposure data report	DID MR-080.01	Monthly, no later than the 10th of the following month

9.0 Property Management Plan

9.0.01 EEG's goal is to ensure that assigned personnel have the correct, workable equipment to efficiently accomplish the job assignment while managing the property in accordance with FAR Part 45.5 and its supplements. To maximize the use of resources, it is imperative that proper inventories are maintained of equipment items that are on hand, the locations of the items, and the working condition of each item.

9.0.02 All government-furnished property (GFP) and contractor-acquired property (CAP) is acquired only if contractually authorized. Title to all property purchased under cost-reimbursable tasks will be vested to the government immediately upon receipt or reimbursement, whichever occurs first. Written approval from the contracting officer is to be obtained prior to the acquisition of any items that are not clearly and explicitly authorized for acquisition in the terms of the contract.

9.0.03 This plan describes the procedures that EEG will use to maintain accountability of its equipment and any GFP used during the field activities in accordance with FAR Part 45.5 and DID MR-005-09.

9.1 Responsibilities for Government Property

9.1.1 Project Manager

The project manager ensures compliance with the EEG property management system by all site personnel who use GFP in support of this task order. He will direct the site manager in all aspects of the property management system and has ultimate authority and responsibility to control, maintain, protect, and preserve GFP in the possession of EEG on this project. The project manager will report any loss, damage, or destruction to the EEG property system manager. He will ensure that each item of GFP is specifically identified in the contract and that any changes in government property are reflected in formal modification to the contracting officer. The project manager will ensure that equipment is used only on the contract for which it is authorized and in accordance with the terms of the contract.

9.1.2 Site Manager

The site manager will be responsible for receiving, marking or tagging, and logging property received directly on site. He will track location, use, and condition of equipment distributed on site and assign equipment to personnel. He will make sure that employees have adequate training for the use of equipment. He will also ensure that the equipment assigned to the site is maintained and calibrated by qualified personnel.

9.1.3 Property System Manager

The EEG property system manager monitors compliance with EEG's property management system. She implements and enforces the property management system for all of EEG's government contracts and is familiar with the contract requirements. She ensures compliance with contract terms, modifications, and other contract administration requirements, and serves as EEG's primary point of coordination with the government property administrator regarding the guidelines set forth in EEG's property management system as they apply to this task order. She marks and tags property received in the EEG office, enters property data into the corporate property tracking database, and coordinates periodic property inventories. She submits required reports to the government property administrator.

9.1.4 Equipment Users

Equipment users will be responsible for the security, condition, proper usage, calibration, and maintenance (before, during, and after use) of equipment.

9.2 Description and Quantity of Materials To Be Used

9.2.1 Field Equipment

9.2.1.01 A preliminary list of field equipment to be used on this project is included in **Table 9-1**.

Table 9-1. Field Equipment

Category	Units	Estimated Cost	Quantity			
			Task 4a Mob / Demob	Task 4b Cerro Balcon	Task 4c Isla Culebrita	Task 4d Other Cays
Suzuki Jeep	Each per week	$280.00	1	21.3	80.4	28.8
Trooper / Week	Each per week	$385.00	2	14.2	26.8	14.4
Drum lifter	Each	$191.53	1			
Backhoe	Day	$75.00	2	11	1	2
Water truck	Day	$75.00		8		

Category	Units	Estimated Cost	Quantity			
			Task 4a Mob / Demob	Task 4b Cerro Balcon	Task 4c Isla Culebrita	Task 4d Other Cays
Boat with pilot	Day	$360.00			122	69
Storage / shipping container	Day	$4,500.00	1			
Centrifugal water pump	Day	$53.00	1	8	27	20
Scales	Each	$ 65.00	4			
Demo kit	Per month	$20.00		1.6	6.2	3.3
Ex. day box (24 X 18 X 12)	Each	$522.37	1			
Explosives delivery (boat)	Day	$500.00		1	2	1
Magazine (delivered)	Lump sum	$3,500.00	1			
Magazine fence (25' X 25' installed)	Lump sum	$2,500.00	2			
Excavating tools	Lump sum	$450.00	1			
Tremble XRS GPS	Month	$1,000.00		1.6	6.2	3.3
GPS dual phase receiver – Base	Month	$1,395.00		1.6	6.2	3.3
Bullhorn	Each	$165.00	1			
Cell phones (2000 min)	Per month	$350.00	0.25	1.6	6.2	3.3
Marine radio (2)	Per month	$30.00		1.6	6.2	3.3
Radio system (6)	Per month	$30.00	1	1.6	6.2	3.3
Video camera / still	Month	$50.00		1.6	6.2	3.3
White's (4 units)	Week (ea)	$60.00		7.1	26.8	14.4
Porta John	Month	$125.00		1.6		
Weed eaters (4)	Each	$781.00	4			
Chain saw	Each	$350.00	1			
Safety cans – gas	Each	$65.00	3			
Machetes	Each	$30.00	6			
Tires	Each	$35.00	4			
Noisemeter / Dosimeter	Lump sum	$856.54	1			

9.2.1.02 EEG will supply one magazine with a cap box for storage of explosives.

9.2.2 Office Equipment

A preliminary list of office equipment to be used during the course of this project is provided in **Table 9-2**.

Table 9-2. Office Equipment

Category	Units	Estimated Cost	Quantity			
			Task 4a Mob / Demob	Task 4b Cerro Balcon	Task 4c Isla Culebrita	Task 4d Other Cays
Cell phones (2,000 min)	Per month	$350.00	0.25	1.6	6.2	3.3
Laptop	Per month	$80.00	0.25	1.6	6.2	3.3
Office rental	Each per week	$150.00	1	7.1	26.8	14.4
Copy / fax / printer machine	Lump sum	$250.00	1			
File cabinet	Lump sum	$856.54	1			
Furniture (desks, tables, chairs)	Lump sum	$300.00	1			

9.2.3 Consumable Supplies

A preliminary list of consumable supplies to be used on this project is presented in **Table 9-3.**

Table 9-3. Consumable Supplies

Category	Units	Estimated Cost	Quantity				
			Task 4a Mob / Demob	Task 4b Cerro Balcon	Task 4c Isla Culebrita	Task 4d Other Cays	Task 7 Environ. Sampling
Diesel fuel	Gallon	$2.25		50			
Gas	Gallon	$2.25	20	393	943.2	522	
Explosives(per demo item)	Per shot	$ 16.87		1.6	128	19	
Temporary explosives storage (vendor)	Day	$75.00		1	2	1	
Explosives delivery (boat)	Day	$500.00		1	2	1	
Tool kits & parts	Lump sum	$400.00	1				
Wood stakes – 4-foot	Per 25	$25.00		4	6	2	
Pin flags	Per 100	$15.00		3	3	3	
Camel Back	Each	$55.00	14				
Survey tape & markers	Each	$5.00		4	8	4	
Drinking water & ice	Day	$5.00		26.2	104.8	58	
PPE & safety supplies	Mo	$50.00		1.6	6.2	3.3	
Expendables	Week	$55.00		7.1	26.8	14.4	

Category	Units	Estimated Cost	Quantity				
			Task 4a Mob / Demob	Task 4b Cerro Balcon	Task 4c Isla Culebrita	Task 4d Other Cays	Task 7 Environ. Sampling
Blades for Weedeaters / Chain saw	Each	$22.00		6	14	8	
Chain saw	Each	$350.00	1				
Polyethylene scoops (10 count)	Per 10	$58.50					5
Sample packing & shipping supplies	Lump sums	$100.00					20
Fix A Flat	Each	$6.50		60			
Delivered sand – bags (50 pounds)	Each	$2.00		100			
Sand bags (shipped)	Per 100	$73.00			2	5	
Internet access	Per month	$100.00		1.6	6.2	3.3	

9.3 Sources and Estimated Rental and Acquisition Costs

The process used in acquiring office furniture, vehicles, equipment, and consumable supplies will be in compliance with FAR Part 45.5. Based on the SOW, EEG has determined that the rental of expensive equipment is the most economical method for equipment acquisition. The digital camera, laptop computer, printer/scanner/fax, and GPS unit will be rented from EEG and shipped to the site. EEG will provide the White’s electromagnetic detectors to be used during the removal action. Based on site conditions and project team size, EEG would rent appropriate vehicles. EEG has some brush-cutting equipment and safety supplies on site from other projects. This equipment will be maintained by EEG and will be rented to the government. EEG will also purchase GFP brush trimmers and other brush-cutting equipment should the old equipment become irreparable.

9.3.1 Rentals

Upon issuance of the notice to proceed for the field activities, EEG project personnel will obtain cost quotes for equipment rentals from three local vendors and suppliers (if enough local vendors are available) to determine the best value (in terms of cost, maintenance, or repairs) to the project. Once a vendor or supplier offering the best value is identified, an account or contract will be developed and schedules for delivery established.

9.3.2 Purchases

Small hand tools, consumables, etc., will be purchased at local supplier outlets to the greatest extent practicable. Purchases of low-cost equipment or consumables will be conducted at local suppliers that offer the best cost for those types of materials.

9.4 Process to Acquire Quotes

Quotes will be obtained from three vendors for each piece of purchased or leased equipment and all supplies in excess of $200 where practical. EEG will acquire material from the vendors that offer the best price, including transport to the island. In instances where EEG does not use the low bid or uses a sole source, justification will be provided. If rental costs over the life of the contract exceed purchase costs, the contracting officer will be notified prior to entering a rental agreement.

9.5 Source for Leased Vehicles

EEG will use a maximum of five vehicles during the on-site work activities. Four-wheel-drive vehicles will be needed for off-road terrain, and small, economical four-wheel-drive vehicles will be used on local roads. These vehicles will be obtained from Jerry's Jeeps and Carlos Jeep Rental.

9.6 Consumable Supplies and Personal Property Included in Overhead Rate

Consumable supplies included in EEG's overhead rate are those associated with general office activities. Due to the general nature of these consumables, they are purchased as part of EEG's overhead and are allocated to projects on an indirect-cost basis.

9.6.1 Reimbursable Expenditures

9.6.1.01 Allowable and unallowable indirect costs are identified under contract Section J, Attachment C.

9.6.1.02 Employee consumables and/or personal equipment are not allowable direct costs; however, the following exceptions are noted:

- Safety equipment (i.e., goggles, gloves, PPE)
- Bug/insect repellant
- Wet Wipes or pre-moistened towelettes

- Bottled water
- Ice (when specifically approved)
- Whistles, air horns
- Sunscreen
- Poison ivy and oak protection and cleaner
- Cups
- Spray paint
- Flashlights
- Batteries
- Shovels and rakes
- Water coolers or hydration units
- Keys

9.6.1.03 The above items, or ones like them, may be charged as direct costs; however, they must be specifically noted on each voucher that claims any of these items.

9.6.2 Unallowable Expenses

9.6.2.01 The following items are unallowable charges (direct and indirect) for this contract.

- Coffee
- Gatorade or sports beverage
- Clocks
- Work uniforms
- Uniform maintenance
- Paper towels
- Toilet paper
- Shaving equipment and supplies
- Laundry items
- First aid kits
- Rain suits
- Office supplies

9.6.2.02 Any deviation from this consumables and personal equipment policy must have contracting officer approval prior to purchase.

9.7 Proposed Storage Plan

All property and equipment at the project site will be stored in lockable containers or inside the office space. When feasible, EEG and government property will be separated. Additionally, EEG may purchase a shipping or storage container to use for equipment storage.

9.8 Disposal Plan

9.8.1 Salvage

9.8.1.01 Salvageable property has some value in excess of its basic material content, but repair or rehabilitation to use for the originally intended purpose is impractical. Repair for any use would exceed 65 percent of the original acquisition cost. The maximum economical use shall be made of repair and salvage items in lieu of using new items.

9.8.1.02 Items with a shelf life will be tracked and stored by the dated shelf life. A “first in, first out” system shall be employed for these items.

9.8.2 Turnover to Government

Government property will be segregated by contract and stored on shelves or bins (when not in use). Requests for the transfer of government property to other projects will be documented with DD Form 1149 (Equipment Transfer Form). Information on the location of all government-owned property will be maintained in the property logs in the possession of the site manager for on-site property and the EEG property system manager or designee for property shipped to EEG’s Newberry, Florida, office.

9.8.3 Other Disposition

9.8.3.01 At the close of the project, termination of the contract, or request for disposal of equipment by the CEHNC project manager, the respective CEHNC property manager will be contacted for disposition procedures.

9.8.3.02 EEG will ensure that reasonable quantities of government property are incorporated into end items or otherwise consumed in the performance of the contract. Excess property items shall be promptly reported to the property administrator.

9.8.3.03 Before an item is declared excess, it is to be screened against need on other contracts. If a need exists, a transfer will be requested through the contracting officer. If any items allocable to a contract are determined excess, they will be promptly reported on the appropriate inventory schedules after the final inventory has been completed, in accordance with FAR 45.6. Once an item has been listed on an inventory schedule, it will be taken out of use and stored separately from all other inventory. No item will be disposed of without proper authority. Documentation in support of disposition shall become a part of the property control records. Prior to beginning the disposition process, the government property administrator will be notified concerning the impending completion of the contract.

9.8.4 Government-Furnished Property Tracking Reporting and Closure

9.8.4.01 When government property is initially received, it is to be inspected by the site manager for any discrepancies in quantity, condition, or description. Discrepancies relative to GFP are to be reported to the EEG's project manager and the government's property administrator or appropriate government official. Upon receipt, all government property will be marked and identified (where applicable) as such by assigning a government ID number and affixing a government property tag.

9.8.4.02 Assignment and/or utilization of government property will be documented through the use of a GFP tracking form. It is the responsibility of the site manager to act as property manager to maintain GFP tracking forms and files and to conduct periodic physical accounting or reconciliation of all EEG and government property.

9.8.4.03 It is imperative that control of all equipment be established upon receipt. Upon delivery, items will be verified against shipping documents and entered on a GFP tracking form and into the project database. A copy of the tracking form will be maintained on site and will be submitted to the contracting officer on a quarterly basis in a summary report.

9.8.4.04 EEG will make sure that all government property is being used for the purpose authorized in the contract and is not diverted to other use, unless express written authorization from the contracting officer is given. The degree of utilization will determine the retention of the property. EEG ensures that all subcontractors maintain government property in their possession in accordance with the provisions of FAR 45.5.

9.8.4.05 In accordance with the provision of FAR 45.505-1 through 45.505-14, EEG will create and maintain the official GFP control records for each item of GFP in a database at EEG corporate headquarters in Newberry, Florida. Each database record contains the contract number or project ID to which the item belongs. Each record also indicates whether the item is GFP or CAP. The records identify all GFP currently accountable to EEG and all transactions.

9.8.4.06 Each record shall contain the following information:

1. Property number
2. Property nomenclature
3. Manufacturer's name
4. Manufacturer's model number
5. Serial number
6. Part number
7. Equipment type
8. Size, capacity
9. Date received
10. Condition
11. Physical location
12. User's name
13. Contract number
14. Unit price
15. Posting reference and date of transaction
16. Date of Disposal and Disposition
17. Quantity received, issued, and on hand
18. National stock number (if provided)

9.8.4.07 Once a contract has been physically completed, all property has been disposed of, the property records have a zero balance, and no credits or open charges are due the government, the following actions will be taken.

1. A closure letter referencing the appropriate contract and stating the above-mentioned facts is sent to EEG's property system manager, who forwards it to the government's property administrator.
2. A final DD Form 1662 (Property in the Custody of Contractors) that shows zero ending balances is sent to EEG's property system manager, who forwards it to the government's

property administrator. A final GFP report will be marked "FINAL AS OF [*current reporting period date*]".

9.8.4.08 When this task order is completed, only a closure letter will be submitted to EEG's property system manager, who forwards it to the government's property administrator. A final DD Form 1662 is not required until all orders under a contract are completed.

9.9 Notification of Loss, Damage, or Destruction of Accountable Government Property

Any instances of loss, damage, or destruction of government property will be reported to EEG's property system manager, who will immediately report it to the government's property administrator. A detailed written report will be prepared by the site manager for lost, damaged, or destroyed property, and forwarded to the EEG project manager. This report will provide a detailed description of what happened, including applicable statements and reports (e.g., police reports), and will be included as part of the weekly status report.

10.0 Quality Control Plan

10.1 Introduction

10.1.1 Policy Statement

This QCP has been developed to comply with appropriate industry and regulatory standards. It will be used to ensure that project-related activities are conducted in a planned and controlled manner, that the product of those activities conforms to contractual requirements, and that appropriate documentation exists to support each activity for which EEG is responsible.

10.1.2 Scope

This QCP consists of the plans, procedures, and organization necessary to produce an end product that meets the requirements specified in CEHNC Contract W912DY-05-D-0007 and the SOW addressing the non-time-critical removal action at the former naval target range on Culebra Island and its surrounding cays. This plan includes a designated QC organization with the authority to enforce all provisions. The plan governs all operations by EEG and its subcontractors, both on and off site. It covers submittals, field activity control, field changes, equipment standardization and maintenance, audits, deficiencies and non-compliance, corrective actions, and associated documentation and recordkeeping. The QCP is designed to follow the sequence of field operations.

10.1.3 Quality Assurance

10.1.3.01 QA will be performed by personnel listed in the project Quality Assurance Surveillance Plan.

10.1.3.02 The government will perform QA on all aspects of this task order. Any portion that fails QA will be redone at no cost to the government.

10.2 Site-Specific Quality Control Plan

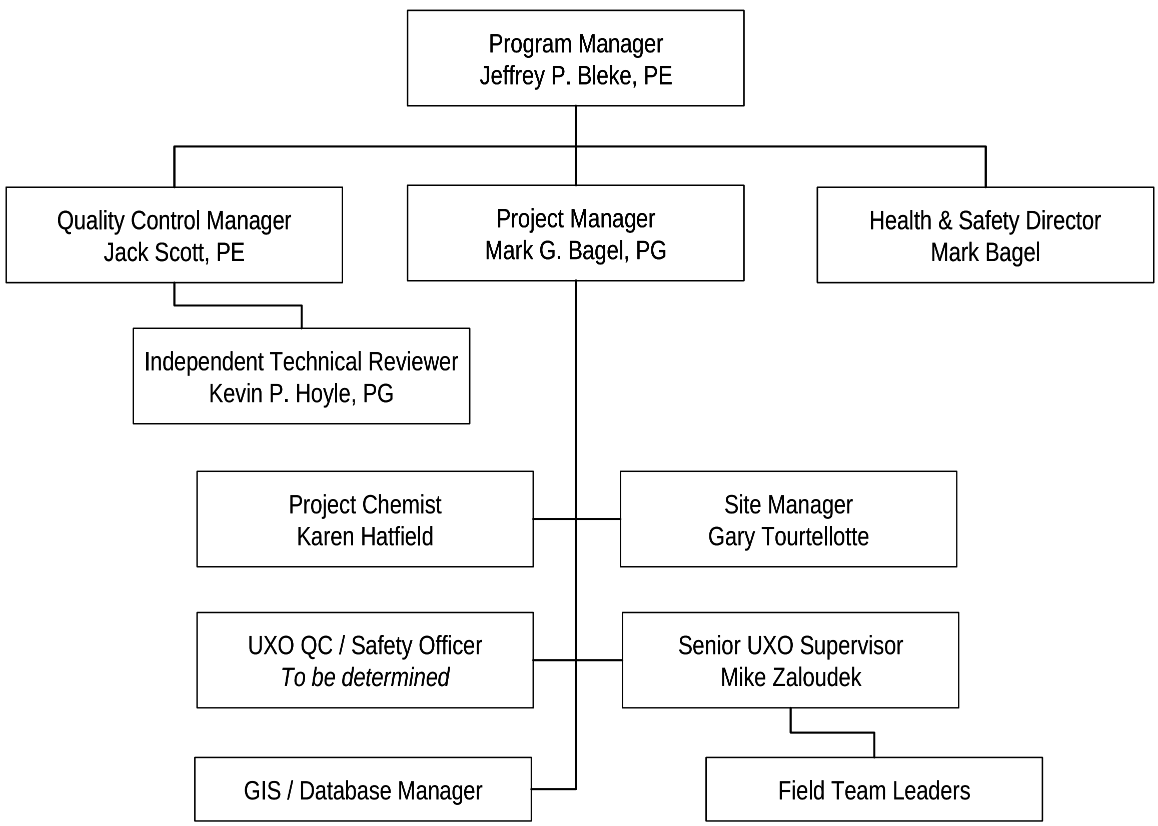
This QCP describes the quality management procedures to be followed during the removal action of MEC at selective areas at Culebra Island, Puerto Rico, and the surrounding cays. Site-specific information includes but is not limited to project personnel, definable features of work, required control operations, equipment tests, specific equipment calibration and response check procedures, audit procedures, and USACE or regulatory agency requirements.

10.3 Quality Control Organization

10.3.01 EEG QC personnel will not be replaced without the approval of CEHNC. The project manager will provide CEHNC with the names, qualifications, duties, and responsibilities of each proposed replacement.

10.3.02 **Figure 10-1** presents an organization chart showing the lines of authority for implementation of the project, and the text following describes the job requirements, responsibilities, duties, and authorities of key QC personnel.

Figure 10-1. Quality Control Organization Chart



10.3.1 Responsibilities and Authority

10.3.1.1 Program Manager

The program manager is Jeffrey P. Bleke. He is responsible for overall direction, coordination, technical consistency, and review of contract activities. Responsibilities and authorities include:

- Final approval and review of work plans, project deliverables, schedules, contract changes, and labor allocations
- Ensuring availability of personnel assigned to the project for the duration of the contract
- Performing quarterly project status reviews to assess compliance with scope, budget, and schedule
- Communicating, as necessary, with CEHNC to evaluate the progress of the program and to facilitate the avoidance of any potential problems

10.3.1.2 Quality Control Manager

EEG's QC manager, Jack Scott, will perform his duties independent of any cost, scheduling, and other performance constraints. These issues are the responsibility of the program manager or the project manager. The QC manager or his representative is considered to be essential personnel and authorized to be on site during clearance operations. The QC manager will be responsible for reviewing and updating the QCP as needed, and for verifying compliance with the plan. Compliance will be verified through audits of project activities conducted by the QC manager or his representative, who has the authority to require corrective actions and stop work (work stoppage will be coordinated with CEHNC), as needed, to ensure compliance with the SOW. Responsibilities will include:

- Ensuring that the site QCP is being properly implemented
- Ensuring that corrective actions are documented and acknowledged by the project manager and field personnel, as well as communicated to the customer, when adverse situations or defective work result from a project activity
- Ensuring that all personnel are properly trained and adequately experienced for the duties assigned
- Ensuring that project deliverables are defined before beginning the field work and submitted as required by the Work Plan and project schedule
- Evaluating the implementation and effectiveness of the QCP on a regular basis
- Ensuring that ground-truthing and feedback processes are being accomplished

- Implementing field investigation QC activities, including field management of ground reconnaissance activities and environmental protection programs
- Scheduling to ensure that the QC personnel are on site during all field activities
- Delegating QC duties to qualified staff members (QC staff will report to and be supervised by the QC manager)

10.3.1.3 Health and Safety Director

EEG's health and safety director, Mark Bagel, will be responsible for implementing the corporate health and safety program, reviewing and monitoring compliance with project-specific health and safety plans, implementing corrective measures for health and safety deficiencies, and ensuring required training and medical monitoring of personnel. The health and safety director has the authority to require corrective measures related to health and safety issues and to stop work, if required, to ensure a safe working environment. Responsibilities include:

- Investigating all injuries and illnesses
- Assisting in the development of corrective action plans
- Implementing corrective action plans to eliminate or mitigate hazards

10.3.1.4 Project Manager

The project manager, Mark Bagel, has the responsibility and authority for day-to-day management of all operations and has the authority to stop any phase of work deemed necessary to achieve a safe work environment and good quality work. Responsibilities include:

- Review and approval of sampling, testing, field investigation methods, and QC, including designs, schedules, and labor allocations
- Preparation of progress reports with the assistance of key support personnel
- Management of funds for labor and materials procurement
- Technical review of all project deliverables
- Establishment and enforcement of work element milestones to ensure timely completion of project objectives
- Implementation of corrective action in response to Non-Conformance Reports
- Response to Non-Conformance Reports within 30 days, or as stipulated in the audit report
- Frequent communication with CEHNC regarding day-to-day progress of the project

10.3.1.5 Independent Technical Reviewer

The independent technical reviewer, Kevin Hoyle, PG, will:

- Review each designated contract deliverable
- Provide comments on all deficiencies
- Review comments and responses
- Sign certification form indicating document completion

10.3.1.6 Project Chemist

The project chemist, Karen Hatfield, will be responsible for:

- Implementing the field QC plan
- Performing as single point of contact for all chemical quality discussions
- Working with project QC manager or his representative to ensure the quality of the field data
- Interfacing with the subcontractor analytical laboratories and receiving notification of sample receipts from the analytical laboratories
- Working with the project team in reporting deficiencies and ensuring that corrective actions have been implemented

10.3.1.7 Site Manager

The field site manager, Gary Tourtellotte, is responsible for the daily conduct of all operations at the project site. He has the authority to stop any phase of work deemed necessary to achieve a safe work environment and good quality work. The duties of the site manager will include:

- Daily work assignments
- Personnel and resource assignments
- Monitoring and tracking the progress of each operable phase of work
- Reviewing QC documentation
- Reporting daily progress to the project manager
- Providing weekly report data to the project manager
- Conducting weekly project meetings, and coordinating with project safety and quality management personnel
- Interfacing with the customer, site visitors, and off-site EEG personnel

10.3.1.8 UXO Quality Control / Safety Officer

10.3.1.8.01 One individual (to be determined) will act as both the UXO QC officer and the UXO safety officer (UXOQC/SO) on this project.

10.3.1.8.02 In his capacity as the UXO safety officer, the UXOQC/SO is responsible for performing the routine duties for health and safety functions, with the assistance of the health and safety director. He will administer the Site-Specific Health and Safety Plan and addenda. Responsibilities include:

- Conducting daily safety briefings
- Performing regular and frequent site inspections to find hazards and observe personnel at work
- Stopping work when necessary to prevent injury or illness
- Ensuring personnel and environmental health and safety
- Investigating all injuries and illnesses
- Developing and implementing corrective action plans to eliminate or mitigate hazards

10.3.1.8.03 In his capacity as the UXO QC specialist, he reports directly to the QC manager in the performance of his duties, is the senior QC staff member on site, and is responsible for the implementation and enforcement of the QCP. Responsibilities include:

- Verifying site training and current hazardous waste operations and emergency response (HAZWOPER) and medical monitoring documentation
- Ensuring that all site surveillance activities and audits are conducted and documented in accordance with the QCP
- Ensuring all QC reports are provided in the proper format, as required by the QCP
- Authorizing corrective actions as required to ensure that all work complies with the QCP and stipulated contractual requirements
- Ensuring that MEC-related materials have been completely removed from the site
- Reviewing and verifying correct ID for all recovered MEC and munitions debris
- Checking for defective or damaged equipment
- Verifying that appropriate personnel are being used during all field operations
- Performing and documenting daily audits or surveillances of job activities
- Performing follow-up checks and correction of all deficiencies prior to the start of additional features of work

- Verifying that all required equipment calibration has been performed and that inspection and standardization results comply with contract requirements and the Work Plan
- Maintaining all audit and surveillance documentation

10.3.1.9 GIS / Database Manager

Duties and responsibilities will include:

- Ensuring that the database is designed and established prior to commencement of field investigations
- Ensuring that data for each activity is properly incorporated into the project GIS
- Ensuring that metadata is accurately maintained in accordance with the Work Plan

10.3.1.10 Senior UXO Supervisor

Duties and responsibilities will include:

- Conducting and supervising equipment maintenance and function checks
- Supervising intrusive investigations
- Ensuring safety during all MEC removal operations
- Ensuring that all personnel are properly trained
- Ensuring that all field logs for MEC removal operations are updated daily
- Ensuring safe, compliant transportation of explosives
- Ensuring that explosives management activities are conducted in accordance with the Work Plan and governing regulations
- Ensuring that site-preparation activities are completed in accordance with the project Work Plan
- Ensuring that MEC removal operations are conducted in conformance with the project Work Plan

10.3.1.11 Field Team Leaders

Team leaders are responsible for the conduct of the field work assigned and for direct supervision of team members. Duties will include:

- Performing QC checks
- Documenting field activities in daily logs
- Supervising field operations

- Participating in project meetings
- Adhering to all safety and quality requirements in accordance with the Work Plan

10.3.2 Qualifications and Training

10.3.2.01 EEG maintains personnel files for each employee. These records include copies of licenses, training records, and certificates of qualifications that support employees' placement and position. Prior to an employee's initial assignment or any change in duties/assignments, the project manager reviews the employee's licenses, training records, and certificates to ensure that the employee is qualified. EEG will ensure that the UXO-qualified personnel meet standards required by CEHNC and will submit a letter request with resumés and UXO number from the UXO database to CEHNC for approval prior to mobilizing to the site.

10.3.2.02 A file on all UXO personnel will be maintained to include EOD certification, current medical monitoring physical, 40-hour HAZWOPER safety training certification, 8-hour HAZWOPER supervisor certification, and current annual refresher training as required by this Work Plan. Prior to the start of field activities, EEG will also submit to CEHNC the resumés for EEG's field personnel that were not included in Appendix H of this Work Plan.

10.3.2.03 All other training and health records for field personnel will be maintained on site, including 40-hour OSHA health and safety training certificates, 8-hour supervisor training records, 8-hour annual refresher course, certificate of medical clearance and annual physical examination, current certificate for cardiopulmonary resuscitation (CPR) training and first aid, and other applicable certifications.

10.3.2.04 Specific training for field equipment, including GPS and geophysical operations and procedures, will be provided to all personnel during the initial safety briefing and site-specific training. Training is conducted by the UXOQC/SO, the project manager, and the SUXOS. Attendance records (and student performance when applicable) are maintained. Prior to assignment to a duty position or change in duty position, the UXO technician assigned QC duties performs a check of the individual's site personnel record to ensure that the employee is qualified to fill the position.

10.4 Quality Management System

10.4.1 Deliverables

10.4.1.01 The Work Plan and reports will be developed by the project manager and reviewed by the EEG program manager prior to submittal to CEHNC. Funding- and budget-related items will be developed by the EEG project manager and reviewed by the EEG program manager prior to submittal to CEHNC. Data collection and assemblage for task-specific reporting requirements will be conducted by the site manager. Site data will be reviewed and finalized by the project manager prior to submittal to CEHNC in weekly and monthly reports. Final reports will be prepared by the project manager and reviewed by the EEG program manager prior to submittal to CEHNC.

10.4.1.02 Any contractual changes or change requests will be prepared by the project manager and reviewed and submitted by the EEG program manager.

10.4.2 Field Activities

As stated in Subchapter 10.3.1.8, the EEG UXOQC/SO will perform daily inspection and surveillance of all work areas to maintain control over field activities identified in the Work Plan. The controls will ensure that qualified personnel and approved procedures and equipment are used, and that specified process parameters and environmental conditions are maintained. Also, the controls will ensure that all requirements of the contract are met. **Table 10-1** provides a list of controls to ensure that proper equipment and procedures are being used, specific parameters monitored, and how they will be maintained.

Table 10-1. Quality Control Checks, Parameters, and Corrective Actions

Measured Item	Controls Used	Parameter Measured	Corrective Action
Work attire (PPE)	UXOQC/SO inspects to ensure that proper PPE is being worn and that PPE is in good condition, meeting the requirements of EM-385-1-1 and OSHA standards.	Accepted / rejected	Equipment shall be maintained by the field personnel and will either be accepted or rejected. Rejected PPE will be tagged and removed from operation after concurrence by SUXOS.

Measured Item	Controls Used	Parameter Measured	Corrective Action
Equipment operation	UXOQC/SO will verify that instrument checks are being conducted at least three times a day. UXOQC/SO will randomly affix inert target items beneath a blanket in such a manner as to conceal the number and types of items during the test. Operator will perform equipment balancing, then locate the items under the blanket.	Frequency and accuracy of measurement (pass / fail)	Equipment shall be maintained by the field personnel and will either be accepted or rejected. Rejected sensors will be tagged as non-operable and removed from the site after concurrence by SUXOS.
	UXOQC/SO will verify that the operator is able to consistently maintain a height of operation and ability of the equipment to detect target items.	Height must be equal to or less than the determined height. Operator must be able to easily locate the items buried at the site.	Equipment shall be maintained by the field personnel and will either be accepted or rejected. Rejected PPE will be tagged and either repaired or thrown out after concurrence by site manager.
Vehicle	General-use vehicles will be inspected daily by UXOQC/SO to ensure that they are safe.	Complete parameters in the Daily Vehicle Inspection Form	Daily-use vehicles will be maintained by the field team and will be inspected by UXOQC/SO. The results of the inspection will be reviewed by site manager. If there are deficiencies in the equipment, EEG site manager will notify CEHNC site representative for concurrence whether the equipment should be used or removed from the site.
	Vehicles used for transport of explosives will be inspected prior to use by UXOQC/SO to ensure that they are safe.	Review parameters located on the Vehicle Inspection Form (Transport of Hazardous Material)	Vehicles used for transport of explosives will be maintained by the field team and/or the supplier. These vehicles will be inspected by UXOQC/SO. The results of the inspection will be reviewed by SUXOS. If there are deficiencies in the equipment, EEG site manager will notify CEHNC site representative for concurrence whether the equipment should be used or removed from the site.
Brush-cutting equipment	All brush-cutting equipment will be inspected daily by the UXOQC/SO to ensure that the equipment is operating and safe for use.	Each piece of equipment will be checked to ensure that it can be safely operated, that all safety guards are in place, that proper PPE is used, and that the blades are not chipped or cracked and are in sharp condition. If these parameters are found to be acceptable, UXOQC/SO will complete the appropriate box on the Quality Management System Checklist.	Equipment shall be maintained by the field personnel and will either be accepted or rejected. Rejected equipment will be tagged as non-operable and removed from the site after concurrence by SUXOS.

Measured Item	Controls Used	Parameter Measured	Corrective Action
Emergency equipment, first aid kit, burn kit, fire extinguisher	UXOQC/SO will inspect to ensure that the equipment is on site and in the appropriate locations (i.e., magazine compound, vehicles, office, etc.), that it is in good condition, and that it meets the contract requirements.	UXOQC/SO will denote that the conditions and the quantities of safety equipment are acceptable on the safety inspection checklist.	Equipment will be maintained by the field personnel and will be either accepted or rejected. Rejected equipment will be tagged as non-operable and removed from the site after concurrence by SUXOS.
Grid layout	UXOQC/SO will inspect to ensure that the appropriate grid corners are located and that sweep lanes are being set up in a proper manner.	UXOQC/SO will inspect the grid layout operation and the setup of the grid lanes. The Quality Management System Checklist will be completed with his findings.	The layout of the grids will be either accepted or rejected. If the width of the grid lanes is less than or equal to 4 feet, the work will be acceptable. If the distance is greater than 4 feet, UXOQC/SO will ask the team leader to reset the lanes and redo the search already conducted.
Search techniques	UXOQC/SO will observe the search techniques. The search techniques must be accomplished in a manner that all target items identified in Table 6-1, Step 6, are located. Hazardous items found that are smaller will also be removed.	UXOQC/SO will check that proper techniques are being used; that the speed of the operation is such that the target items will be checked to ensure sensor head speed is sufficient to locate MEC items, sweeping at the appropriate height; and that the sweep coverage is complete under trees and shrubs. He also ensures that all surface items are immediately identified and that partially penetrating items are being flagged and excavated, and that all MEC items are properly flagged and located for GPS data collection. Acceptance of these procedures will be noted in the daily Quality Management System Checklist.	If improper search techniques are being employed, UXOQC/SO will discuss the deficiencies with SUXOS and will get concurrence for the proper corrective action. He will re-inspect the operation to ensure that the corrective action is being applied.
	UXOQC/SO will randomly seed areas of the grid(s) with no more than 10 concealed, inert target items to be detected as a test of equipment and operation of the equipment. The number of items will be randomly chosen. Seed items will consist of 6-inch iron nail spikes painted blue for easy identification.	Each team must be able to find and identify all inert target items seeded within a grid. The team leader will record the lane number, the operator number, and the item found.	If teams fail to detect and identify one item among those seeded in a grid, a root cause analysis will be performed.

Measured Item	Controls Used	Parameter Measured	Corrective Action
Search techniques (continued)	UXOQC/SO will perform field-level QC checks by lanes or groups of lanes with the purpose of identifying missed items of concern.	If MEC is found, a QC failure is logged. If an anomalous item (a piece of metal smaller than the QC/QA failure threshold) is found and was not positively identified during the initial sweep, the corrective action in the adjoining column will be initiated, and the anomaly will be logged on the QC grid log along with the location, the operator, the action taken, and the percent swept.	If one anomalous item is found, UXOQC/SO will evaluate the failure and the equipment will be rechecked and its operation evaluated. If 5 anomalous items are found, EEG will resurvey 10 percent of the grid or lane groups within that grid at the operator level. If more than 5 anomalous items are found, EEG will resurvey 25 percent of the grid or lane groups within that grid at the operator level. If 10 anomalous items are found, EEG will resurvey the entire grid or all lane groups for that operator within that grid.
Grubbing equipment	UXOQC/SO will ensure that grubbing equipment is operated safely and that operators are grubbing to the level required to ensure full coverage of the area with the sensors.	UXOQC/SO will inspect to ensure compliance with the safety plan and EM-385-1-1. The acceptance of these procedures will be noted in the daily <u>Quality Management System Checklist</u>.	If improper grubbing techniques are being employed, UXOQC/SO will discuss the deficiencies with team leader and SUXOS and will get concurrence for the proper corrective action. He will re-inspect the operation to ensure that the corrective action is being applied.
Tamping and demolition shot	UXOQC/SO will ensure the proper setup of tamping and demolition shot operations and will ensure that all safety protocols have been met as described in Chapters 2 through 4 of this Work Plan.	UXOQC/SO will inspect to ensure compliance with this Work Plan. The acceptance of these procedures will be noted in the daily <u>Quality Management System Checklist</u>.	If improper tamping and demolition operation techniques are being employed, UXOQC/SO will discuss the deficiencies with team leader and SUXOS and will get concurrence for the proper corrective action. He will re-inspect the operation to ensure that the corrective action is being applied.
Team leaders' daily paperwork	UXOQC/SO will inspect the completion of paperwork from the field team leaders.	The work conducted by the field team leader will be documented in a time log. Team leaders will also complete <u>Equipment Operational Check Logs</u>, <u>Demolition Shot Logs</u>, <u>Explosives Consumption Certificates</u>, <u>Grid Sweep Logs</u>, and <u>Surface Soil Sampling Forms</u>. UXOQC/SO will inspect these documents and ensure that they are completely filled out and that the information is correct. The acceptance of these forms will be noted in the daily <u>Quality Management System Checklist</u>.	UXOQC/SO and/or SUXOS will inspect these forms on a daily basis. If these forms are found incomplete, the team leader will be asked to redo the forms. Site manager will inspect the <u>Surface Soil Sampling Forms</u>.
Office paperwork	UXOQC/SO will inspect the completion of paperwork from SUXOS.	SUXOS will prepare a time log of activities occurring during the day, <u>Daily Operations Log</u>, <u>Debris Inventory Log</u>, <u>Explosives Accountability Log</u>, and <u>MEC Accountability Log</u>.	UXOQC/SO will inspect these forms on a daily basis. If these forms are found to be incomplete, SUXOS will be asked to redo the forms.

Measured Item	Controls Used	Parameter Measured	Corrective Action
Office paperwork (continued)	UXOQC/SO will inspect the completion of paperwork from site manager.	Site manager will be responsible for keeping a time log for his activities. He will conduct database entry, assist the UXOQC/SO with the completion of the daily QC log, complete the Chemical Quality Control Report, and review Surface Soil Sampling Forms. Site manager will also check daily to see if the UXOQC/SO has completed the proper forms and he will assist the UXOQC/SO as needed in the completion of his forms.	UXOQC/SO will inspect these forms on a daily basis. If these forms are found incomplete, site manager will be asked to redo the forms.
Mapping and UXO data	UXOQC/SO will inspect the location of the control point and ensure proper setup of the GPS. Appropriate consideration will be given to satellite coverage and the stable positioning of the device on a tripod.	SUXOS will ensure that the base station, if used, is placed over the control point and that the height of instrument is documented; that the data collection rate is 10 seconds; that the batteries are charged; and that the instrument is in proper working condition. He will assign responsibility of the GPS setup to a team member who will be responsible for ensuring that the equipment is operating properly and that it is fully charged. UXOQC/SO will ensure that the Rover is properly set up and that it is coordinated with the base during data collection operations. He will also ensure that a minimum of 5 minutes of data collection is performed over each MEC location.	UXOQC/SO will inspect the setup on a daily basis. If the setup is found to be improper, the data must be re-collected. If the data cannot be re-collected, a non-conformance memorandum will be issued.
	Site manager will download and inspect the data collected.	Site manager will check to ensure that the data collected is correctly and that the location IDs for soil samples, MEC locations, and demolition locations match the descriptions and location IDs provided in the database.	Site manager will download and inspect the GPS data collected and ensure that the process has been completed properly each day data is collected. If the data is incomplete or does not meet the accuracy requirements, site manager will contact the project manager to determine what corrective action is necessary.
	Project manager will receive and review a weekly download of all data collected.	Project manager will verify that all data collected will meet all data goals identified in Chapter 7 of this Work Plan.	If the data is not completed properly, project manager will notify CEHNC project manager and the corrective action process will be initiated.

Measured Item	Controls Used	Parameter Measured	Corrective Action
Soil sampling and analysis	Site manager will inspect all documentation of soil samples collected.	Site manager will ensure that the data is correct, that the soil sampling forms are properly completed, that the condition of the samples is acceptable, that the chains of custody are completed, and that the samples are properly packed prior to sampling. UXOQC/SO will ensure that the samples are collected as per the Field Sampling and Analysis Plan.	If the sampling procedures are incorrect, the corrective action will be initiated. The non-compliance will be issued and the corrective action will be undertaken as provided in the Field Sampling and Analysis Plan.

10.4.2.1 Pre-Mobilization Quality Control Process

Prior to mobilization, the EEG project manager will conduct a preliminary readiness review to assess the completion status of a punch list of items that could delay mobilization. A final readiness review will be conducted when the project preparation team reports that all items on the punch list have been executed. The final readiness review will also act as a preparatory phase meeting to discuss the schedule and expectations with the client, subcontractors, and key personnel.

10.4.2.2 Initial and Interim Field Inspections

10.4.2.2.01 An initial inspection will be conducted of equipment, supplies, and site conditions prior to the start of the project. Video and digital pictures will be taken of the inspected items to ensure that claims will not be made on these items.

10.4.2.2.02 The EEG QC manager or his/her representative will perform periodic inspections of job site activities. Appropriate technical assistance will be provided to perform the inspections, as necessary, for the specific field investigation activities being performed.

10.4.2.2.03 Prior to mobilization, the EEG UXOQC/SO will verify the following:

- Inspect the quality of workmanship
- Verify compliance with contract requirements
- Compliance with approved required submittals
- Verification that all required equipment calibration and response checks have been performed and that results comply with contract requirements and the Work Plan
- Check for defective or damaged equipment

- Verification, inspection, and documentation of delivery and storage of material and equipment to the site
- Performance of follow-up checks and correction of all deficiencies prior to the start of additional features of work that may be affected by the deficient work (EEG will not conduct field operations using non-conforming investigative work methods)

10.4.2.3 Final Inspection

10.4.2.3.01 At the completion of all field work or any defined increment of the field work, the UXOQC/SO manager or his representative will conduct a completion inspection with the CEHNC representative of the work and develop a punch list of any issues that need to be addressed. After the punch list is completed EEG will address all issues on the punch list to ensure all remaining issues have been resolved. A final inspection will be conducted with the CEHNC representative prior to demobilization to ensure compliance issues have been met. Prior to demobilization, the EEG UXOQC/SO will inspect the site to:

- Ensure that all demolition and excavation areas are repaired to a reasonable state
- Verify that all government-furnished equipment purchased during this project has been sent to its final destination
- Ensure proper shipment and storage of documents produced during the field effort
- Inspect the sites with the client representative to ensure there are no remaining punch list items that have not been addressed

10.4.2.3.02 The punch list will be included in the QC documentation that will also include the estimated date by which the deficiencies were corrected.

10.4.3 Documentation

10.4.3.01 All inspection documentation will be maintained in the project files and will include:

- Quality Management System Checklist and Quality Control Reports (forms included in Appendix F)
- All equipment calibration and response and equipment maintenance results
- QC-related meeting minutes
- All non-conformance and corrective action documents as well as audit documentation

10.4.3.02 These documents will include the following information:

- EEG personnel and their areas of responsibility, qualifications, and project-specific training
- Weather conditions
- Operating equipment, with hours worked, idle, or down for repair
- Work performed each day, including location, description, and personnel performing the work
- Test and/or control activities performed with results and references to contract requirements (deficiencies will be noted along with corrective action)
- Quantity of materials received at the site with statement as to acceptability, storage, and reference to contract requirements
- Submittals reviewed, with contract reference, reviewer's name, and action taken
- Job safety evaluations stating what was checked, results, and instructions or corrective actions
- Instructions given or received and conflicts (if any) with contract requirements
- Chemical Quality Control Reports of sampling activities

10.4.3.03 The Quality Control Report will be the primary document, with all other applicable reports and forms attached to it. The QC Report will be submitted to the CEHNC and CESAJ-DP-S project managers weekly. Reports will be signed and dated by the UXOQC/SO. The report from the UXOQC/SO will also include copies of any reports prepared by subordinate QC personnel.

10.4.4 Surveillance and Monitoring

Surveillances will be performed for the definable features of work. These will help to ensure that quality controls have been properly implemented in accordance with the Work Plan. Elements to be monitored are presented on the Quality Management System Checklist, which is provided in Appendix F. The areas to be monitored will include:

- Site management
- Survey and location mapping
- Geophysical detection and mapping
- MEC removal operations

- MEC disposal
- Documentation

10.5 Equipment Maintenance and Response Checks

10.5.01 All tools, instruments, and equipment deployed to the project site will be properly maintained and calibrated (as necessary) in accordance with the instrument manufacturers' specifications or standard industry practice. This applies to equipment used in the field for UXO safety support and related activities affecting quality, including geophysical instruments, communications equipment, vehicles and machinery, environmental monitoring equipment, and PPE. Rulers, tape measures, levels, and other such devices need not be standardized if normal commercial equipment provides adequate accuracy but will be maintained in good working condition.

10.5.02 Equipment will be protected from dust and contamination and visually checked for damage prior to use. Preventive maintenance on the trimmers will be performed on a regular basis according to the manufacturers' operating instructions or recommendations. Critical spare parts will be kept on hand to minimize downtime.

10.5.03 All electromagnetic detectors and GPS units will be checked daily for operational function against a known (standard) source to ensure that quality standards are maintained. An Equipment Operational Check Log (included in Appendix F) will be used to document these checks. The records will indicate the time and date of the check, the item name, and the item's serial number or ID number. Each completed weekly log will be dated and signed.

10.5.1 Electromagnetic Detectors

All electromagnetic detectors will be checked daily against a known metallic anomaly sources. The procedure to be used is presented in Chapter 6 of this Work Plan. Detectors that fail to detect the simulators or metallic sources in the field will be considered to have failed QC and will be removed from service until repaired or recharged.

10.5.2 GPS Units

The Trimble Pro XR GPS receivers used for navigation purposes and recording data will be checked daily over a known control point. Each unit will be checked for adequate battery voltage, correct configuration, and receipt of sufficient data to compute three-dimensional positions. The

GPS units must provide ±1-foot accuracy. If this is not attainable, then the data will be post-processed using a base unit or by correction through a satellite correction service.

10.5.3 Radios and Cellular Telephones

10.5.3.01 At the beginning of each work day and before departure from the field office, each radio and cellular telephone will be checked to ensure that it is operating properly. A radio check will be performed by contacting the office base station or the handheld radio of the SUXOS or UXOQC/SO. Cellular telephones will be checked by placing a call to one of the field office land lines.

10.5.3.02 The UXOQC/SO will perform random communication checks with each team to ensure that proper communications are maintained. Proper operation of cellular telephones will be verified by reading the built-in digital display that indicates that the user is in a service area.

10.5.3.03 Maintenance will include cleaning the equipment and turning it off before inserting into the battery charger. Maintenance will be the responsibility of the individual to whom the equipment is signed out.

10.5.3.04 Documentation of the status of communications equipment will be recorded on the Quality Control Report (provided in Appendix F). Each form will be typed or clearly filled out in black ink, and the data entered into the on-site database. Each document will become part of the official site record. Site personnel will keep a record of all substantive telephone conversations related to the performance of the project. Substantive telephone calls are defined as all calls to or from government personnel that require action by either the government or EEG or that directly or indirectly affect contract terms and conditions; all calls to or from federal, state, or local regulatory agency personnel; and all calls to contractor personnel that require the calling party to be referred to the Antilles Region Public Affairs Office.

10.5.4 Vehicles and Associated Equipment

10.5.4.01 Each day, before a vehicle leaves the field office area, the vehicle's operator will perform a check of the vehicle. The check will include under-the-hood and safety equipment checks and will be documented on the Vehicle Inspection Form (see Appendix F). Under-the-hood checks will include fluid levels, belts, hoses, and checks for leaks. Safety equipment checks will include windshield wipers, fire extinguishers, first aid kits, vehicle horn and lights, and tires.

10.5.4.02 During operation, checks or maintenance will include cleaning the equipment and replenishing any expended safety equipment. After operation, checks or maintenance will include cleaning the equipment and replenishing any expended safety equipment.

10.5.5 Hand Tools and Site-Specific Items

10.5.5.01 Hand tools and site-specific items such as demolition kits will be inspected before use, or at least weekly, to ensure that they are complete and in good repair.

10.5.5.02 Items that are not normally included in the site inventory may be required on individual sites. These items may include PPE or special tools. Special tools or equipment acquired after the site is opened will be included in the site inventory.

10.6 Records Management

10.6.01 The UXOQC/SO will document in his daily QC journal, on the appropriate form, the results of his inspections of records, audits, QC checks of grids, and the corrective action for quality defects. QC records of audits and inspections will be maintained on site and available for government inspection. The QC inspections are not a substitute for the accountability of EEG personnel in supervisory positions. The field team leaders are responsible and accountable for accomplishing and documenting operator-performed maintenance and proper operation of all equipment assigned to their UXO teams.

10.6.02 Field forms and field logbooks completed by the field team leader and UXOQC/SO will be reviewed by the SUXOS on a daily basis. The SUXOS will check to ensure that the proper MEC ID, explosives inventories, demolition data, and other documented information is consistent and accurate between each of the forms. The SUXOS will submit the documents to the site manager for review, acceptance, and filing into three-ring binders.

10.6.03 The site manager will provide daily QC reports to the EEG project manager to ensure that data will be available for the completion of the weekly status reports to the client.

10.6.04 The site manager will populate the appropriate metadata into the site GIS database. The updated database will be submitted to the EEG project manager to ensure that the database meets the GIS requirements of the contract.

10.7 Field Changes

10.7.01 Approved work plans, technical procedures, and design documents will be followed during the course of field investigation activities, except in the case of some unforeseen contingency. In such instance, the performer of the task is required to determine the best approach toward satisfactory completion of the task through the following actions.

- If warranted, stop affected activities until the project manager and/or acting QC manager evaluates the situation.
- Initiate the field change approval process.

10.7.02 Should a change in the Work Plan be required, it will be submitted to the CEHNC project manager for acceptance. Only those changes impacting budget or schedule will be submitted to the contracting officer in accordance with FAR 52.

10.7.1 Responsibilities

10.7.1.01 Any individual who recognizes the necessity for a field change is responsible for initiating appropriate field changes and completing and submitting the Field Change Request Form for review and approval by the EEG project manager, the CEHNC project manager, and the CEHNC contracting officer.

10.7.1.02 The project manager is responsible for:

- Evaluating validity and acceptability of the field change request with respect to the contract requirements
- Evaluating and documenting the effect of the field change on project costs
- Coordinating with the QC manager
- Accepting, qualifying, or rejecting the field change
- Soliciting and obtaining approval from CEHNC for any technical, budgetary, or scheduling changes to the contract prior to performance of any work affected by the proposed changes

10.7.2 Procedures

10.7.2.01 Field changes will be documented by completing the Field Change Request Form and describing the reasons for the change, the recommended disposition, cost impact, impact on previous work, and type of change (minor, major, major project impact). The signed and dated form will be immediately provided to the EEG project manager and QC manager for review.

10.7.2.02 The EEG project manager forwards the Field Change Request Form to Huntsville CHENC for direction and approval.

10.7.2.03 Upon completion of the review and approval process, the project manager forwards the Field Change Request Form to the UXOQC/SO and the SUXOS for implementation, as follows.

- The personnel responsible for the work will implement the change.
- The UXOQC/SO will note the final disposition of the field change request (e.g., change incorporated and work completed, change rejected and work performed per original requirements) on the Field Change Request Form.
- The completed Field Change Request Form will be submitted to the project file.
- The project manager will incorporate any approved cost adjustments into the budget and schedule work breakdown structure.

10.7.3 Records

The UXOQC/SO will verify that all Field Change Request Forms are attached to all on-site copies of the Work Plan. He will also track the status of all field change requests in the Quality Control Report.

10.8 Comprehensive Site Audits

10.8.01 A comprehensive site audit is an examination and evaluation to determine whether applicable elements of the site-specific QCP and Work Plan have been performed, documented, and effectively implemented in accordance with specified requirements. Audit objectives are:

- To assess the adequacy, effectiveness, and thoroughness of the QCP and Work Plan
- To verify conformance with approved procedures, work plans, drawings, specifications, and procurement documents
- To identify quality deficiencies
- To verify correction of previously identified quality deficiencies

10.8.02 Comprehensive site audits may be performed if:

- Significant changes are made in functional areas of the QCP, such as significant reorganization or procedure revisions
- Evidence exists of a serious breakdown in the implementation of the QCP
- A systematic, independent assessment of program effectiveness is necessary
- Implementation of recommended corrective actions must be verified

10.8.1 Responsibilities

10.8.1.01 The QC manager will be responsible for:

- Implementing an audit program
- Reporting quality deficiencies to management
- Reviewing and evaluating comprehensive and daily audit reports to determine if quality deficiency trends are developing
- Auditing site work on a periodic basis and submitting Non-Conformance Reports for non-compliance
- Reporting non-compliance to the project manager and program manager

10.8.1.02 The QC manager (or his designee) will audit project-related files and activites. Re-auditing to verify implementation and satisfactory completion of recommended corrective actions will be performed as deemed necessary.

10.8.1.03 The UXOQC/SO will be on site full-time to conduct daily audits of MEC removal activities and documentation.

10.8.1.04 The program manager will review all audit reports.

10.8.2 Comprehensive Site Audit Report and Follow-Up

10.8.2.01 Following an audit, the QC manager or his representative will prepare and sign an audit report, which will include the following:

- Audit scope
- Audit date
- Auditor ID
- Controlling documents
- Personnel contacted

- Audit result summary, including an evaluation statement of elements audited
- ID of any Non-Conformance Reports
- Quality Audit Checklist for UXO Sites

10.8.2.02 The report, with attached Non-Conformance Reports, will be distributed to the project manager within 30 days of the audit. The project manager will review the audit report and any Non-Conformance Reports. If a Non-Conformance Report has been issued, the project manager will determine and schedule appropriate corrective action to prevent recurrence. The project manager will describe the corrective action taken on the Non-Conformance Report and submit the notice to the QC manager within 30 days after audit report issuance.

10.8.2.03 The QC manager will:

- Verify that the project manager completes the appropriate sections of the Non-Conformance Report and submits the form within the designated time
- Review the response and determine whether it is satisfactory
- Evaluate evidence of completion of corrective action to determine whether the action taken is satisfactory
- Request an additional response if the response and/or corrective action is unsatisfactory
- Close the Non-Conformance Report, if the response and/or corrective action is satisfactory

10.9 Non-Conformance and Corrective Action

EEG will follow non-conformance and corrective action protocols in order to:

- Verify that conditions adverse to quality (non-conformances) are identified and reported to appropriate management levels
- Verify that non-conforming items (e.g., test data, analyses) are appropriately marked and/or segregated and not used until corrective action has been completed
- Verify that appropriate corrective actions or dispositions (i.e., accept, reject, repair, rework) have been recommended, approved, and implemented
- Provide a system for the review and analysis of conditions adverse to quality (nonconformance) to determine their causes and trends, and to verify that corrective actions will preclude recurrence of adverse conditions.

10.9.1 Responsibilities

10.9.1.01 All EEG project team personnel will be responsible for identifying and reporting non-conformance.

10.9.1.02 The supervisor of the activity is responsible for:

- Evaluating non-conformances to determine if the work should be stopped
- Proposing corrective action
- Implementing corrective action
- Evaluating non-conformance impact on prior work or on previously obtained data (if any), and notifying all individuals and organizations that may be affected by the nonconformance and resulting data

10.9.1.03 The project manager and QC manager are responsible for:

- Evaluating non-conformances to determine if the work should be stopped, and/or if the non-conformance should be reported to CEHNC
- Approving the proposed corrective action or disposition
- Verifying that the corrective action or disposition has been satisfactorily implemented
- Providing (if necessary) CEHNC with a written report of any non-conformance

10.9.1.04 The QC manager is responsible for reviewing non-conformances to determine if trends adverse to quality are developing, and for proposing and implementing long-term corrective action to prevent recurrence of any identified non-conformance trends.

10.9.2 Procedure

10.9.2.1 Identification and Reporting of Non-Conformance

A non-conformance exists if there is a deviation from or non-compliance with the contract SOW and contract requirements, the QCP, approved procedures, work plans, or other project requirements. Non-conformances also include major errors in documented analysis, data, or results, and deficiencies in documentation or any other aspect of the project that affect quality. Personnel who identify a non-conformance will report the condition by:

- Completing the Problem Description section of the Non-Conformance Report (see Appendix F)

- Requesting a Non-Conformance Report number from the QC manager, who will enter the Non-Conformance Report on the log
- Distributing the Non-Conformance Report to the project manager and QC manager

10.9.2.2 Evaluation of Non-Conformance Report

10.9.2.2.01 The QC manager and project manager will review the Non-Conformance Report to determine if:

- Ongoing work should be stopped. (If work stoppage is required, work will be stopped as outlined in Subchapter 10.9.2.6.)
- The non-conformance constitutes a significant condition adverse to quality, and in such a case, will determine the cause of the condition. Examples of significant conditions adverse to quality are failures to implement the QCP, major errors in data or analyses that had previously been approved, major deviation from the contract or CEHNC-approved work plans, major deviations from the SOW, and conditions that may affect the cost or schedule of the work. Non-conformances that constitute significant conditions adverse to quality will be reported to CEHNC.
- The non-conformance has any impact on previously obtained data or reports submitted to CEHNC or other organizations. If affected, the project manager will note the impact in the Description section of the Non-Conformance Report and notify in writing all individuals and organizations that may be affected by the non-conformance and resulting data.

10.9.2.2.02 The proposed corrective action will be documented through completion of the Corrective Action section of the Non-Conformance Report.

10.9.2.3 Recommendation of Corrective Action or Disposition

Persons determining corrective action or disposition will have demonstrated competence, will have an adequate understanding of the requirement, and will have access to pertinent background information (e.g., the engineer responsible for the Work Plan). The QC manager will recommend corrective action or disposition to resolve the non-conformance. In the case of a non-conformance, the corrective action will be such as to preclude recurrence of the non-conformance. The recommended corrective action or disposition will be reviewed and approved by the project manager and the UXOQC/SO.

10.9.2.4 Corrective Action Implementation and Verification of Implementation

The approved corrective action or disposition will be implemented by appropriate personnel. When corrective action is completed, the Quality Assurance Verification section of the Non-Conformance Report will be signed and dated by the UXOQC/SO.

10.9.2.5 Client Notification and Approval History

10.9.2.5.01 A hard copy of the Non-Conformance Report will be provided to the CEHNC project manager for review upon issuance and resubmittal through the correction action and QA verification process. His response will be annotated on the Client Notification Summary Section of the Non-Conformance Report. A courtesy copy of each Non-Conformance Report will be submitted to EQB for review.

10.9.2.5.02 The approval history will be noted during each step of the implementation and review of the Non-Conformance Report. All persons concurring with the document will sign the Approval History section of the Non-Conformance Report.

10.9.2.6 Work Stoppage

10.9.2.6.01 Work stoppage authority resides with the QC manager, project manager, site manager, UXOQC/SO, and CEHNC.

10.9.2.6.02 If it is determined that work will be stopped, it will be noted in the Corrective Action section of the Non-Conformance Report; the conditions necessary for work to resume will also be noted and coordinated with CEHNC.

10.9.2.6.03 The supervisor will direct project personnel to stop all affected work. Work will not be restarted until the conditions required to restart work have been satisfied and written approval has been received from the QC manager. All work stoppages will be reported to CEHNC.

10.9.2.7 Tracking of Non-Conformance Reports

The QC manager will monitor Non-Conformance Reports to determine if trends adverse to quality are developing. If such trends are developing (e.g., repetitive Non-Conformance Reports related to a particular activity or organization), the QC manager will issue a written report identifying the problem to the project manager.

The project manager will evaluate the identified problem and propose and implement a written corrective action program to prevent recurrence of the non-conformance.

10.10 Lessons Learned

10.10.01 During the course of field activities, data or information may be discovered that could eliminate or reduce challenges and/or offer opportunities for quality and productivity improvements through value engineering. These lessons learned will be valuable tools in updating plans and procedures for subsequent field activities to include further geophysical and intrusive investigations.

10.10.02 Lessons learned will be captured and documented in the Quality Control Report prepared by the UXOQC/SO and the site manager.

10.10.1 Weekly Quality Management Debriefings

The EEG UXOQC/SO will be responsible for conducting weekly quality management debriefings. These debriefings will be held with a CEHNC safety specialist (when on site), the SUXOS, subcontractor representatives, and the team leaders (if necessary). The site manager will be included in the meetings and will prepare meeting minutes. Discussions during these meetings will include but not be limited to project status, safety issues, QC issues, lessons learned, and future schedule.

10.11 Chemical Data Quality Management Plan

See Appendix E, Munitions Constituents Sampling and Analysis Plan for chemical data quality management.

11.0 Environmental Protection Plan

11.0.01 Appendix J outlines the Protected Species and Habitats Protocols that will be used in this project.

11.0.02 The purpose of this site-specific Environmental Protection Plan is to establish the procedures to be implemented during the MEC removal action activities that will minimize impacts to the surrounding environment. EEG will coordinate all MEC clearance activities associated with this plan with the CEHNC. As established in the "Preliminary Points of Agreement between the Department of the Army and the Puerto Rico Environmental Quality Board," EQB is the lead regulatory agency. A copy of the agreement is included in Appendix A after the SOW. **Table 11-1** provides ARARs for environmental protection as identified by USACE in coordination with EQB. **Table 11-2** provides the "to be considered" guidance documents.

Table 11-1. Applicable or Relevant and Appropriate Requirements

Activity	ARAR	Citation	Applicability or Relevance
Location-Specific			
Presence of endangered or threatened species or critical habitat of such species as designated in 50 CFR 17 or 50 CFR 226	Endangered Species Act of 1973 as amended	16 USC 1531 et seq. 50 CFR 402	On-site actions must comply with the substantive requirements of the Endangered Species Act.
Presence of essential fish habitat	Magnuson-Stevens Fishery, Conservation and Management Act	50 CFR 600.920(e)(3) 16 USC 1801	On-site actions must comply with the substantive requirements of the Magnuson-Stevens Fishery, Conservation and Management Act.
Archeologically significant site	National Historic Preservation Act	16 USC 470	On-site actions must comply with the substantive requirements of the National Historic Preservation Act.

Table 11-2. To Be Considered Guidance

Activity	Guidance	Citation	Applicability or Relevance
Worker and Public Safety	DoD Ammunition and Explosives Safety Standards	DoD 6055.9-STD	Establishes uniform safety standards applicable to ammunition and explosives, to associated personnel and property, and to unrelated personnel and property exposed to the potential damaging effects of an accident involving ammunition and explosives during development, manufacturing, testing, transportation, handling, storage, maintenance, demilitarization, and disposal.
	Ammunition and Explosives Safety Standards	DA PAM 385–64	This pamphlet provides force protection guidance for commanders with an ammunition or explosives mission. It provides procedures to protect military and civilian Army employees, the public, and the environment. It also sets forth procedures for use when transporting ammunition or explosives over the public highway. Provides guidance for the remediation of active and Formerly Used Defense Sites contaminated with ammunition and explosives.

11.0.03 Both the surface and subsurface clearance activities under this contract may require that MEC be blown in place. The following chapters of this Work Plan provide detailed procedures for the mitigation of blast effects when MEC is blown in place or removed to a consolidated shot area for detonation:

- Chapter 3, Explosives Management Plan
- Chapter 4, Explosives Siting Plan
- Appendix D, Accident Prevention Plan

11.0.04 The EEG site manager and SUXOS will be responsible for ensuring that all site work is performed in accordance with this plan and any applicable local or federal regulations.

11.0.05 Prior to the start of any on-site work, a species and habitat survey will be conducted. The result of the survey will be recorded and submitted to the appropriate regulatory agencies for information purposes. EEG will proceed in accordance with the procedures established in Appendix J.

11.1 Resources

All surface preparation and clearance activities will be conducted in a manner to minimize impacts to land resources within and outside of the project boundaries. These boundaries will be established during the pre-clearance survey. In addition, work areas will be cleared of all non-essential personnel prior to MEC clearance activities.

11.1.1 Endangered and Threatened Species

11.1.1.01 Endangered and threatened plant and animal species inhabit specific areas of the Culebra Archipelago. It is essential that site personnel maintain close coordination with the responsible environmental resources agencies to avoid disturbing any of these species. The point of contact for endangered species coordination is the chief of the Caribbean field office of FWS, in Boqueron.

11.1.1.02 In the event that a threatened or endangered species is harmed as a result of clearance activities, EEG will notify the contracting officer.

11.1.1.03 Access to the cays will be coordinated with the responsible environmental resources agencies.

11.1.1.04 The following table lists the known endangered and threatened species that may be located in the area.

Table 11-3. Threatened and Endangered Species Potentially Occurring in Culebra Island Archipelago

Classification	English Common Name	Spanish Common Name	Latin Name	FWS ESA Status	Puerto Rico Status
Marine mammals	Sperm whale		*Physter catodoc*	E	NL
	Humpback whale	Ballena jorbada	*Megaptera novaeangliae*	NL	V
	Finback whale		*Balaenoptera physalis*	E	NL
	West Indian (Antillean) manatee	Manatí antillano	*Trichechus manatus manatus*	E	E
	Caribbean monk seal*		*Monachus tropicalis*	E	E
Birds	Brown pelican	Pelícano pardo	*Pelicanus occidentalis occidentalis*	E	E
	Peregrine falcon	Falcón peregrino	*Falco peregrinus tundrius*	NL	CE
	Roseate tern	Palometa	*Sterna dougalli*	T	V
	Masked duck	Pato dominico	*Oxyura dominica*	NL	E
	Ruddy duck	Pato chorizo	*Oxyura jamaicensis*	NL	V
	Caribbean coot	Gallinazo caribeño	*Fulica caribaea*	NL	V
	Least grebe	Tigua	*Tachybaptus dominicus*	NL	DD
	West Indian whistling duck	Chiriria antillano	*Dendrocygna arborea*	NL	CE
	White cheeked pintail	Pato quijada colorada	*Anas bahamensis*	NL	V

Classification	English Common Name	Spanish Common Name	Latin Name	FWS ESA Status	Puerto Rico Status
Birds	Least tern	Gaviota chica	*Sterna antillarum*	NL	DD
	White crowned pigeon	Paloma cabeciblanca	*Columba leucocephala*	NL	DD
	Bridled quail dove	Paloma perdiz de Martinica	*Geotrygon mystacea*	NL	DD
	Piping plover	Chorlo melódico	*Charadrius melodus*	T	CE
Reptiles	Hawksbill sea turtle	Carey de concha	*Eretmochelys imbricata*	E	E
	Leatherback sea turtle	Tinglar	*Dermochelys coriacea*	E	E
	Green sea turtle	Peje blanco	*Clelonia mydas*	T	E
	Loggerhead sea turtle	Cabezón	*Caretta caretta*	T	NL
	Virgin Islands tree boa	Boa de Islas Vírgenes	*Epicrates monensis granti*	E	CE
	Puerto Rican boa	Boa puertorriqueña	*Epicrates inornatus*	E	V
	Slipperyback skink	Lucía	*Mabuya mabouya sloanei*	NL	V
	Culebra giant anole	Lagartijo gigante de Culebra	*Anolis roosveltii*	E	CE
	Puerto Rican slyder	Jicotea	*Trachemys stejnegeri*	NL	DD
Plants	Wheeler's peperomia		*Peperomia wheeleri*	E	E
	Square stem cactus		*Leptocereus grantianus*	E	NL

*Caribbean monk seal is presumed extinct

Key:
CE = Critically endangered; DD = Deficient data; E = Endangered; NL = Not listed; T = Threatened; V = Vulnerable

Sources:
DNER 2004 (Regulation No. 6766); FWS 2005 (Puerto Rico species lists at URL http://ecos.fws.gov/tess_public/servlet/gov.doi.tess_public. servlets. RegionLists?lead_region=4#PR); ESEW.org 2005 (http://www.esew.org/warning_lists/usa_teritory/puertorico/ puertorico.htm)

11.1.1.1 Benthic Habitats

11.1.1.1.01 NMFS has proposed that elkhorn (*Acropora palmata*) and staghorn (*A. cervicornis*) corals be listed as threatened under the ESA (FR Vol. 70, No. 88:24359, May 9, 2005). Staghorn coral is a branching coral with cylindrical branches ranging from a few centimeters to over two meters in length and height. It occurs in back reef and fore reef environments from 0 to 30 meters depth. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Although *A. cervicornis* colonies are sometimes found interspersed among colonies of *A. palmata*, they are generally in more protected, deeper water or seaward of the *A. palmata* zone and hence protected from waves (*Acropora* BRT 2005). Fore reef zones at intermediate depths (5 to 25 meters) were formerly dominated by extensive single species stands of staghorn coral until the mid-1980s. Elkhorn coral is a large branching coral with exceptionally thick and sturdy antler-like branches forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Colonies prefer exposed reef crest and fore reef environments in depths of less than 6 meters, although isolated corals may occur to 20 meters. The preferred habitat of *A. palmata* is the seaward face of a reef (turbulent shallow water), including the reef crest, and shallow spur and groove zone (*Acropora* BRT 2005).

11.1.1.1.02 Both elkhorn and staghorn corals underwent precipitous declines in abundance in the early 1980s throughout their range, and this decline has continued. The major threats to the existence of these corals are disease, elevated temperature, and hurricanes. Disease was identified as the single largest cause of both elkhorn and staghorn coral mortality and decline. Hurricanes appear to be the main factor for the large-scale decimation of elkhorn coral (*A. palmata*) biotopes in Puerto Rican reefs (Garcia-Sais et al. 2005). Less severe stressors include anchoring and subsequent breakage of corals. Their branching morphology makes them particularly susceptible to breakage. The creation of fragments through breakage is a natural means of asexual reproduction for these species; however, the fragments must encounter suitable habitat to be able to reattach and create a new colony (FR Vol. 70, No. 88:24359, May 9, 2005).

11.1.1.1.03 Brief descriptions of some acroporid reefs in Puerto Rico were described by the *Acropora* Biological Review Team (2005) and are excerpted verbatim in the following paragraphs.

> In Puerto Rico, well-developed and dense thickets of *A. cervicornis* were present through the late 1970s at many reefs surrounding the main island, and also the offshore islands of Mona, Vieques and Culebra (Almy and Carrión-Torres 1963, McKenzie and Benton 1972, Rogers 1977, Goenaga and Cintrón 1979, Boulon 1980). Later, in 1978-79 during an island-wide survey, *A. cervicornis* was found on only 20% of those reefs (Bruckner 2002). Unfortunately, quantitative trend data sufficient for a case study to depict trend in *A. cervicornis* abundance or distribution are not available from Puerto Rico. A recent description of the status of *A. cervicornis* in Puerto Rico can be found in Bruckner (2002); a few other studies are summarized below:
>
> - Along the shelf-edge reef south of Puerto Rico, *A. cervicornis* was the dominant coral prior to Hurricane David in 1979. Twenty random 0.6 m^2 photoquadrats were selected from each of ten 40-m long transects parallel to the depth contours across the reef (16.7 to 19.2 m depth). Based on analysis of point count data, *A. cervicornis* had a mean of 31.1% total cover (range of 9.9 to 56.9%) prior to the storm; after the storm, total cover of *A. cervicornis* dropped to a mean of 0.90% (range of 0.02 to 2.7%) (Boulon unpubl. data).

- With the exception of a few reefs in the southwest and isolated offshore locations, the dense, high profile, monospecific thickets of both species (*A. cervicornis* and *A. palmata*) have disappeared from Puerto Rico coral reefs (Weil et al. unpublished data).
- In the summer of 2004, there was an epidemic outbreak of white pox disease at Los Corchos coral reef in Culebra, Puerto Rico. Coral cover on the reef reaches values of 80%; a total of 80 to 90% of the *A. cervicornis* colonies at a permanent monitoring site were already dead or dying three weeks after Tropical Storm Jeanne (Rogers, pers. comm.).

11.1.1.2 Birds and Reptiles

11.1.1.2.01 The cays surrounding Culebra are known nesting areas for shorebirds, seabirds, and sea turtles. Although seabirds may be present on the cays year round, the majority of shorebird and seabird nesting occurs during the spring and summer months. Critical times that MEC should not be detonated because of seabird activity are April through September; this would also be protective of most sea turtle nesting. All work schedules will be coordinated with the responsible natural resource agencies to avoid or mitigate possible disturbance of sensitive species during nesting seasons.

11.1.1.2.02 The volcanic rocks and cays of northeastern Puerto Rico provide a suitable habitat for the nesting of marine birds. These rocks and cays are unstable and subject to erosion despite their dense vegetative cover. Fourteen species of marine birds nest in the Culebra archipelago (Saliva 2005) (see following table). On the Island of Culebra and on Cayo Yerba, Saliva and Burger (1989) found that sooty terns selected nest sites that had taller vegetation and more cover over the nest and that were farther from open areas.

Table 11-4. Nesting Marine Birds of the Culebra Archipelago

Latin Name	Spanish Common Name	English Common Name
Anous stolidus	Cervera	Brown noddy
Larus atricilla	Gaviota cabecinegra	Laughing gull
Phaethon aethereus	Chirre de pico colorado	Red-billed tropicbird
Phaethon lepturus	Chirre de cola blanca	White-tailed tropicbird
Puffinus lherminieri	Pampero	Audobon’s shearwater
Sterna anaethetus	Gaviota monja	Bridled tern
Sterna dougalli	Palometa	Roseate tern
Sterna eurygnatha	Gaviota de cayena	Cayenne tern

Latin Name	Spanish Common Name	English Common Name
Sterna fuscata	Gaviota oscura	Sooty tern
Sterna maxima	Gaviota real	Royal tern
Sterna sandvicensis	Gaviota piquiaguda	Sandwich tern
Sula dactylatra	Boba enmascarada	Masked booby
Sula leucogaster	Boba parda	Brown booby
Sula sula	Boba patirroja	Red-footed booby
Source: Saliva 2005		

11.1.1.2.03 Roseate tern (palometa), a threatened species, arrives at the end of April and begins nesting in the middle of May. Nesting areas may be moved from year to year. If reproduction is successful, juveniles and adults leave Culebra at the end of July or early August. Nesting pairs of roseate tern have continually declined from 300 in 1988 to 15 to 25 in the 1990s. Population estimates in 2000 and 2004 indicated no more than 15 pairs (Saliva 2005). Roseate terns usually hide their nests under some sort of protective cover such as rocks, vegetation, or washed-up debris (Spendelow 1995). Caribbean birds use a variety of substrates, including open sand and coral rubble, rocky cliffs, and low islands. Nesting sites may be densely vegetated or bare. Varying amounts of debris and vegetation may be present in the nesting area.

11.1.1.2.04 The Atlantic Coast piping plover (*Charadrius melodus*) population breeds on coastal beaches from Newfoundland to North Carolina (and occasionally in South Carolina). The piping plover’s winter range extends along the Atlantic and Gulf coasts from North Carolina to Mexico and into the Bahamas and West Indies (FWS 1996). Plovers appear to prefer sandflats adjacent to inlets or passes, sandy mudflats along prograding spits, and overwash areas as foraging habitats (FWS 1996, 50 CFR 17).

11.1.1.2.05 NMFS (FR Vol. 63, No.170, September 2, 1997) designated critical habitat pursuant to the Endangered Species Act of 1973 (ESA) for the threatened green turtle (*Chelonia mydas*) to include waters extending seaward 3 nautical miles (5.6 kilometers) from the mean high water line of Culebra Island. These waters include Culebra’s outlying cays, including Cayo Norte, Cayo Ballena, Cayos Geniqui, Isla Culebrita, Arrecife Culebrita, Cayo de Luis Pena, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo Botijuela, Alcarraza, Los Gemelos, and Piedra Steven. The extensive seagrass beds of the Culebra archipelago support a large juvenile population of green turtles.

11.1.1.2.06 On November 10, 1993, FWS designated Culebra seagrass beds as Resource Category 1, recognizing these seagrasses as critical foraging habitat for juvenile green turtles. Resource Category 1 designation recognizes the habitat as unique and irreplaceable on a national or ecoregional level and states that loss of the habitat is not acceptable. The seagrass beds of Culebra consist primarily of turtle grass (*Thalassia testudinum*). In the Caribbean, turtle grass beds consist primarily of turtle grass but may include other species of seagrass such as manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), and sea vine (*Halophila decipiens*), as well as several species of algae including green algae of the genera *Halimeda, Caulerpa,* and *Udotea.*

11.1.1.2.07 Nesting hawksbill sea turtles prefer low-energy sandy beaches with woody vegetation such as sea grape or saltshrub located within a few meters of the water line. Suitable nesting habitat can be extremely variable and ranges from high-energy ocean beaches to tiny pocket beaches only a few meters in width. Nests are typically placed under vegetation (NMFS/FWS 1993). The nesting season varies with locality, but in most locations nesting occurs some time between April and November. Hawksbills nest at night and, on average, about 4.5 times per season at intervals of approximately 14 days. On Isla Culebrita, all beachfront areas on the southwest-facing shore, east-facing shore, and northwest-facing shore of the island from mean high tide inland to a point 150 meters from shore have been designated critical habitat for hawksbill sea turtles (50 CFR 17.95).

11.1.1.2.08 The largest concentration of nesting leatherback sea turtles in the United States Caribbean has been documented at Sandy Point National Wildlife Refuge, St. Croix, and Playa Brava and Playa Resaca on Culebra Island. Nesting females prefer high-energy beaches with deep and unobstructed access. The Island of Culebra and St. Croix beaches have the greatest density of leatherback nests within United States waters. In the wider Caribbean, major nesting commences in March (a few nests may be laid from December to February) and continues into July (NMFS/FWS 1992). On Culebra, the nesting season begins in February and continues through July. Hatching may begin as early as April and continues through September. Leatherbacks nest in sand near the vegetation line on the beach (http://www.coralations.org/turtles/index.htm). Atlantic leatherbacks nest an average of six times from March to July, with approximately 10 days between the nesting episodes. Often turtles will lay their nests in areas that are under water during high tide.

11.1.1.2.09 In the Atlantic, leatherbacks nest from November to April (http://www.speciesatrisk. gc.ca/search/speciesDetails_e.cfm?SpeciesID=274). In St. Croix, the nesting period extends from February 9 to August 11, with each turtle laying an average of 5.26 nests per season with an inter-nesting interval of 9.6 days (Boulon et al. 1996).

11.1.1.2.010 On Culebra and the surrounding cays, the slipperyback skink (*Mabuya mabouya*) is listed as vulnerable in DNER Regulation No. 6766 and in the Draft Puerto Rico's Comprehensive Wildlife Conservation Strategy. This skink is found in dry tropical forests in leaves, rocks, and trunks. Slipperyback skink was restricted to dry scrub woodland and littoral forest in the Dominican Republic (citation Ricklefs and Lovette 1999).

11.1.2 Water Resources

11.1.2.01 The work sites are located in areas where water features such as lakes and ponds are intermittent and contain water only during extreme rain events. Lakes and ponds, even though they exist in some Culebra Island locations, are not located in the proposed work sites. A small cattle watering pond is in the Cerro Balcon area. Drainage features only intermittently contain water. No streams are located on Culebra.

11.1.2.02 Lagoons are located on the northwest portion of Isla Culebrita within the strafing range project area. Saline ponds and lagoons are particularly important to migratory waterfowl such as blue-winged teal, as well as the resident white-cheeked pintail and several waders. The usual fringe of mangroves surrounding these saltwater ponds provides habitat for nesting populations of herons, pigeons, and many songbirds (http://biology.usgs.gov/s+t/SNT/ noframe/cr133.htm).

11.1.2.03 Groundwater is not commonly encountered on Culebra Island or the surrounding cays due to the limited thickness of soil and the shallow igneous rock; therefore, groundwater resources will not be adversely affected by site operations.

11.1.3 Wetlands

The proposed work will not be conducted in submerged wetlands areas. The wetlands areas will be identified during a survey. EEG personnel will perform required tasks in a manner that will minimize the possibility of surface runoff that may affect the wetlands. EEG field supervisors will monitor work sites for situations that could cause wetlands impact and will alert the appropriate agency.

11.1.4 Cultural and Archaeological Resources

11.1.4.01 The archeological survey will be conducted concurrently with the species and habitat survey by an archeologist meeting the Department of the Interior's Professional Qualification Standards for Archeology

11.1.4.02 During operations, personnel will visually inspect the site for cultural and archaeological artifacts. Care will be taken during clearance activities to avoid disturbance of cultural artifacts. Any items found will be marked, and the CEHNC project manager will be notified of the finding. Work in the immediate area of an artifact will be halted until a qualified person properly inspects the item. The government retains ownership and control over historical and archaeological resources.

11.1.4.03 EEG employees will be informed that they are not permitted to remove cultural artifacts from the site and will be subject to disciplinary action if they fail to comply with this requirement. They will also be informed that they must notify the EEG project manager immediately upon finding non-MEC-related manmade items on the site. The item(s) will be left where it was found unless it might be impacted by detonation of MEC. EEG personnel will obtain the GPS coordinates of the item, photograph the item, and notify the EEG project manager immediately of the potential find. The EEG project manager will notify the CEHNC and CESAJ project managers and submit the findings data to them by e-mail for quick notification to the State Historic Preservation Officer.

11.1.5 Coastal Zones

11.1.5.01 The MEC removal sites are located in the upland areas in Cerro Balcon; however, the removal action will also include beaches in and around Isla Culebrita and the other cays included in the SOW. Operations on Isla Culebrita and other cays will require transport of work crews and equipment via boat. All landing and transport areas will be coordinated with the responsible natural resource agencies.

11.1.5.02 A benthic survey will be conducted for the purposes of locating appropriate anchoring and access locations for the cays. The results of the survey will be documented and provided to the appropriate regulatory agencies. The survey will be used by EEG to determine best access routes to the cays and anchorage locations which will minimize impacts to the environment.

11.1.5.03 Twelve benthic habitat types were identified in the Luis Peña Canal Natural Reserve (Hernández-Delgado 2003). These included linear reef, colonized bedrock, colonized pavement, scattered coral rock, colonized pavement with channels, patch reef, seagrass (four categories based on percent cover), macroalgae plains, and sand.

11.1.5.04 The additional smaller cays are generally surrounded by coral habitat (see benthic habitat maps in Appendix I). Garcia-Sais et al. (2001) provided a description of reefs of the Cordillera de Fajardo Natural Reserve that lies between Culebra and Fajardo, Puerto Rico. “Rock reefs” are the most abundant and prominent formation within reserve boundaries. These are mostly found on the windward side of islets and thereby exposed to very high wave action, particularly during the winter. Biological assemblages are generally limited to encrusting biota (including corals), with low vertical relief and providing only a minor contribution to the physical structure of the reef. “Patch reefs” are generally small, submerged reef structures surrounded by a sandy substrate, sometimes consisting of only one large coral colony. Patch reefs are common along the leeward side of the larger islets. Coral reefs are best developed as “fringing reefs” on the leeward (protected) section of the chain of islets at the northern boundary of the reserve. Turf algae habitat generally dominates percent cover estimates of the benthic habitat (Garcia-Sais et al. 2005, 2001).

11.1.5.05 The work crew landing and staging area on Isla Culebrita would likely be the dock area located on the southwestern side of the island. A secondary area would be the mooring buoy in the Bahia Tortuga; however, this would require crews to wade to the beach. Work on Culebrita is expected to take approximately 127 days. Work schedules will be coordinated with the responsible environmental resources agencies to avoid bird and sea turtle nesting seasons, and to avoid damage to benthic habitats.

11.1.5.06 Landing, anchoring, and staging areas for the additional cays will be determined in conjunction with regulatory agencies before work starts on those cays. The smaller cays are largely inaccessible except during the calmest seas, and landing areas may necessarily vary depending on wind and wave direction. Out of necessity, landing areas would generally be on the leeward side of the cays, the side that generally has the best developed reefs. Work on the cays is anticipated to take approximately 72 days and will begin in October 2006. The following table provides the estimated number of days required to complete surface clearance operations on each of the cays and Isla Culebrita.

Site Name	Estimated Acres	Estimated Clearance Days
Isla Culebrita	82	127
Cayo Botella	3	12
Cayo Tiburon	1	3
Los Gemelos	2	5
Cayo del Agua	2	5
Cayos Geniqui	4	7
Cayo Alcarraza	7	10
Cayo Lobo	20.5	30

11.1.5.07 To reduce fragmentation distance and potential for fire, detonations of munitions up to 155 mm will be tamped with biodegradable sandbags or water bags. If MEC is deemed acceptable to be moved, it will be moved toward the site interior at a distance greater than 200 feet from the shoreline for detonation. If MEC is deemed unacceptable to be moved and occurs less than 200 feet from the shoreline, it is possible that sandbag remnants could be blown into the water. Sandbag remnants landing in the water would cause minimal adverse impacts and would not reduce the quality or quantity of essential fish habitat, would cause no cumulative impacts, and would not adversely effect populations of species listed in Caribbean Fishery Management Council management plans.

11.1.5.08 Water containment may be used rather than sandbags. Water to fill the containment system would be pumped from nearshore environment. Water would be obtained from the site's adjacent waters utilizing a centrifugal trash pump. These pumps typically have pumping rates of 200 to 400 gallons per minute with a 2-inch to 4-inch intake port. Water containment could require up to 1,100 gallons of water. Small invertebrates, zooplankton, ichthyoplankton, and juvenile or small fish could potentially be entrained in the intake water. Given the small volumes of water needed (approximately 1,000 gallons) and the short duration of pumping (approximately five to ten minutes) the wetting operations would produce a minimal adverse and short-term impact. To further reduce the entrainment potential of juvenile and small fish, the end of the intake hose may be covered with a screen. The potential minimal and short-term entrainment of organisms would not reduce the quality or quantity of essential fish habitat and would not adversely affect populations of managed species.

11.1.5.09 The worst-case scenario would involve the detonation of 500-to-1,000-pound bombs, if those are discovered. Those larger ordnance items cannot be tamped with sandbags or water.

The detonation of those items would produce fragments that will be blown into the water. The maximum fragment weights for the 500- and 1,000-pound bombs are 0.89 and 0.9 pound, respectively. Maximum fragmentation distances are 3,177 feet for the 500-pound bomb and 3,288 feet for the 1,000-pound bomb. The ranges for no more than one hazardous fragment per 600 square feet are 688 feet for the 500-pound bomb and 813 feet for the 1,000-pound bomb (see MSD calculation sheets in Appendix G). The descent of fragments will be slowed by the water as they settle to the bottom.

11.1.6 Tree and Shrub Removal

11.1.6.01 It is the intent, wherever possible, to prune and trim vegetation instead of removing it. EEG personnel will conduct a pre-removal site survey to document the existing trees and shrubs and identify the extent of the work areas. With the exception of Wheeler's peperomia on Cayo Botella, no known endangered or threatened plants or shrubs have been observed in the work areas, but any desirable flora will be identified and marked by EEG. EEG will revise the removal areas to not include the sensitive areas identified in the species and habitat survey.

11.1.6.02 Brush, undergrowth, and small trees (less than 2 inches in diameter) will be cut and/or removed only to a point that is necessary for surface clearance activities. All trees greater than 2 inches in diameter and not requiring removal will be protected. At Cerro Balcon, trees and shrubs greater than 2 inches in diameter may be required to be removed. Their removal will be coordinated with DNER. Tree removal on the cays and Culebrita is not anticipated. Areas disturbed due to demolition of MEC will be restored to natural grade where possible.

11.1.7 Waste Disposal Sites

11.1.7.01 Solid waste at this site refers to all garbage, refuse, debris or other discharged material (except for hazardous waste or debris and sanitary waste). All solid waste derived during the clearance operations will be collected on a daily basis. As the amount of solid waste derived from this operation will be minimal, it will be collected in plastic bags for disposal at the local landfill located to the south of the Northwest Peninsula. All recyclable debris (metals, etc.) will be taken to appropriate disposal facilities. Cleared brush, trees, and vegetation will be moved off of the work site and contained in organized piles just outside of the work areas.

11.1.7.02 Temporary sanitary facilities will be used for sanitary disposal. Waste derived from these units will be taken to sanitary facilities for disposal.

11.2 Mitigation Procedures

EEG will coordinate all site activities with the appropriate local, territory, and federal regulatory agencies to ensure proper protection of the environment. The following subchapters describe the procedures that will be followed.

11.2.1 Manifesting, Transporting, and Disposing of Wastes

Waste, with the exception of sanitary waste and vegetation debris from clearing operations, will be removed from the site on a daily basis by contractor personnel.

11.2.2 Burning Activities

EEG does not anticipate the use of burning to mitigate any waste at the site.

11.2.3 Dust and Emissions Control

EEG personnel will make concerted efforts to limit the amount of ground disturbance and related dust emissions during the surface clearance operations. Vegetation will be cut to reasonable levels to allow surface clearance operations, but vegetative cover will be maintained as much as possible in order to hold soil in place. The only excavation anticipated is for potentially partially buried MEC, but the average excavation area for ordnance removal would be approximately 2 feet by 2 feet. Very little dust should be generated during this process.

11.2.4 Spill Control and Prevention

11.2.4.01 Due to the nature of site activities, the potential for a spill of hazardous materials is minimal and is limited to potential spillage of small quantities of fuels, radiator fluid, or hydraulic oils. EEG shall take all necessary precautions to prevent spills and provide contingency measures for the cleanup of potential spills during the performance of this project. To minimize the potential for spillage and the impact of spilled materials, EEG shall:

- Store and use minimal quantities of fuels and/or oils
- Utilize work practice controls to prevent spills during refueling and maintenance operations that involve power tools, site vehicles, and equipment (this will include the use of spill pans to collect spilled materials)
- Provide all spill response supplies and equipment necessary to contain spilled materials and to remove and contain materials that become contaminated due to spillage. A spill

containment kit will include absorbent material, a shovel, and a storage container will be available in the vehicle assigned to the UXOQC/SO.

- Develop and implement decontamination procedures that may be necessary for the removal and clean-up of spilled materials

11.2.4.02 Fuel and/or oil spills will be contained using an absorbent material to prevent the spill from spreading over a large area. The absorbent will be allowed enough time to absorb all free products, and then it will immediately be removed to a sealable container. Any soil that may be affected by the spill will be excavated and placed in the same closable container.

11.2.5 Storage Areas and Temporary Facilities

11.2.5.01 Storage areas at the Culebra site will contain fuel, munitions debris, cultural debris, and explosives. These items will not be stored on the cays and on Culebrita.

11.2.5.02 Fuel will be brought in each day in 5-gallon containers to fuel the vehicles and equipment as needed. If fuel storage is required, an area will be set up with proper notification to identify it as a non-smoking area. Additionally, the fuel storage area will include spill containment using a plastic liner or tub underneath each fuel can.

11.2.5.03 Munitions debris and cultural debris will be stored in the proximity of the explosives magazine compound. The magazine compound will be fenced in a manner to inhibit personnel from entering the area. EEG will keep the waste in segregated piles or sealed drums prior to transport from the site.

11.2.5.04 All explosives will be stored in one locked explosives magazine located in a fenced magazine compound in accordance with the procedures detailed in Chapter 4.

11.2.6 Access Routes

11.2.6.01 Care will be taken to ensure that the public does not enter work areas. Barricades will be set up at appropriate distances from the work areas so that all public withdrawal and minimum separation distances are attained. Personnel will man the barricades and patrol the site perimeter prior to demolition operations.

11.2.6.02 All landing and transport areas on cays will be coordinated with the responsible natural resource agencies.

11.2.7 Trees and Shrubs Protection and Restoration

Protection and restoration of trees and shrubs will be accomplished in accordance with Appendix J.

11.2.8 Control of Water Run-on and Run-off

11.2.8.01 Contamination to soils as a result of activities performed during this removal action is not expected; however, when appropriate, all reasonable precautions will be taken to prevent run-on from entering areas of the site. Such precautions may include construction of temporary dikes using off-site materials, use of sandbags, or other actions.

11.2.8.02 All project activities will be conducted in a manner to prevent the discharge of pollutants into adjacent waterways. All toilet facilities will be of the portable chemical type, and disposal of wastes will be to an off-site facility. If any areas are adjacent to wetlands or other bodies of water, sandbags or other barrier devices will be used to reduce the spread of potentially contaminated soil or water.

11.2.9 Equipment Decontamination and Disposal

Equipment contamination is not expected at this site; therefore, decontamination will not be conducted. Soil sampling equipment will be dedicated and pre-cleaned to eliminate the need for decontamination.

11.2.10 Minimization of Disturbed Areas

Areas disturbed during surface clearance operations will be kept to the minimum necessary to accomplish the mission. No disturbance will occur outside the approved work area boundaries.

11.2.11 Procedures for Post-Activity Cleanup

Upon project completion and subject to instructions by the contracting officer, EEG will remove all temporary facilities, stockpiles of excess material, and any other signs of activity. Disturbed areas will be restored to their prior condition.

11.2.12 Air Monitoring Plan

As these sites are remote, air quality monitoring will not be required.

11.2.13 Compensatory Measures

Significant impacts to the essential fish habitats are not anticipated during this field effort. In the case inadvertent and unavoidable impacts to the essential fish habitat occur, EEG will document the damage and notify the contracting officer's representative and the responsible environmental resources agencies. The extent and type of damage as well as the cause will be detailed. The overall impact of the damage will be determined and the contracting officer will assess compensatory measures.

12.0 Investigation-Derived Waste Plan

The Investigation-Derived Waste (IDW) Plan details the requirements for handling and disposing of IDW.

12.1 On-Site Handling

12.1.1 Non-Hazardous Waste

12.1.1.01 Solid waste at this site refers to all garbage, refuse, debris, sludge, or other discharged material (except for hazardous waste or debris and sanitary waste). All garbage and refuse derived during the clearance operations will be collected on a daily basis. As the amount of solid waste derived from this operation will be minimal, it will be collected in plastic bags for disposal at the local landfill located to the south of the Northwest Peninsula. All recyclable debris (metals, etc.) will be taken to appropriate disposal facilities.

12.1.1.02 Soil sampling equipment will be dedicated to each sampling location and therefore will not require decontamination; therefore, decontamination water will not be generated during this field effort.

12.1.1.03 All IDW will be processed in accordance with applicable state and federal laws and regulations.

12.1.2 Hazardous Waste

Hazardous wastes are not expected to be encountered during this MEC project; however, if hazardous materials are suspected, work in the area will be halted and the USACE contracting officer or to the contracting officer’s representative will be immediately notified to request operational guidance. A determination will be made as to what action should be taken.

12.2 Storage, Transportation, and Treatment

12.2.1 Non-Hazardous Waste

Non-hazardous waste will be stored in plastic bags and transported to the landfill on Culebra Island for disposal.

12.2.2 Hazardous Waste

In the unlikely event that hazardous waste is discovered or generated; it will be handled in accordance with applicable regulations, including Department of Transportation Hazardous Material Regulation 49 CFR 100-199.

12.3 Disposal

12.3.1 Non-Hazardous Waste

12.3.1.01 Incidental waste, such as PPE and disposable sampling supplies, will be sent to the local landfill. The amount of such waste derived from this operation will be minimal.

12.3.1.02 A portable toilet will be used to contain sanitary waste only. At least one portable toilet unit per each 15 persons will be required. A service will be used to remove the waste on a weekly basis. Sanitary waste contained will be treated and disposed of by the selected sanitary service and in accordance with local regulations.

12.3.2 Hazardous Waste Manifests

12.3.2.01 A multi-copy manifest form will be used for shipping hazardous waste off site. The form will detail information concerning the generator, transporter, disposal facility, and amount and type of waste. EEG will oversee preparation of waste manifests in accordance with required regulations. A USACE representative will sign all waste manifests as the generator of record.

12.3.2.02 EEG will keep a record of all hazardous waste being disposed of during this project. Records of actual weight of waste, waste profile, and receipts of waste being disposed of will be included in the Quality Control Report.

13.0 Interim Holding Facility Siting Plan for RCWM Projects

As this is not a planned RCWM project, the Interim Holding Facility Siting Plan for RCWM Projects is not required.

14.0 Physical Security Plan for RCWM Project Sites

As this is not a planned RCWM project, the Physical Security Plan for RCWM Project Sites is not required.

15.0 References

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APPENDIX A

Task Order Scope of Work

Performance Work Statement

for

Non-Time-Critical Removal Action

at the

Municipality of Culebra

Culebra, Puerto Rico

Project No. I02PR006802

Performance Work Statement
Non Time Critical Removal Action
Municipality of Culebra
Culebra, Puerto Rico
PROJECT NO. I02PR006802
22 March, 2005

1.0 OBJECTIVE

The objective of this task order is for the contractor to perform a removal action (RA) to remove and dispose of all Munitions of Explosive Concern (MEC) and/or explosive hazards within the selected areas at Culebra, Puerto Rico. The RA shall be in accordance with the signed Action Memorandum.

2.0 BACKGROUND AND GENERAL STATEMENT OF WORK:

2.1 Regulatory Guidelines. The work required under this Scope of Work (SOW) falls under the Defense Environmental Restoration Program - Formerly Used Defense Sites (DERP-FUDS). Munitions and Explosives of Concern (MEC) exist on property formerly owned or leased by the Department of Defense. The terminology used in this Performance Work Statement (PWS) is updated from the terms used in the Action Memorandum.

2.1.1 MEC is a safety hazard and may constitute an imminent and substantial endangerment to the local populace and site personnel. The work associated with this Non Time-Critical Removal Action (NTCRA) shall be performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104, and the National Contingency Plan (NCP), Sections 300.120(d) and 300.400(e).

2.1.2 All activities involving work in areas potentially containing unexploded ordnance hazards shall be conducted in full compliance with Department of Defense (DoD), Department of Army, US Army Corps of Engineers (USACE), federal, state and local requirements regarding personnel, equipment, and procedures. 29 CFR 1910.120 shall apply to all actions taken at this site.

2.2 Culebra came under Navy control in 1901, and the Navy built a small base that same year and an airfield about 20 years later. The Navy used the area for fleet exercises from 1902 until 1975. The Navy began surface and aerial bombing of the Flamenco Peninsula in 1935, and expanded the range to include eastern and western cays (small islands surrounding Culebra) in the early 1960s. Ordnance firing ended in September 1975.

Culebra Island National Wildlife consists of Culebra Island and about 20 cays surrounding Culebra Island which are owned by the Fish and Wildlife Service (FWS). Total land area is about 7300 acres, and the FWS owns approximately 1500 of these acres. The rest is owned by the Commonwealth of Puerto Rico, primarily the Department of Natural and Environment Resources (DNER).

The six hundred (600) acre Northwest Peninsula was used primarily for shore bombardment centered on white-washed rocks along the shoreline, simulated gun emplacement, white-washed Sherman Tanks, and white-painted fuel drums. Targets were placed mid-peninsula for napalm and aircraft delivery of inert bombs and rockets.

2.3 Chemical Warfare Materiel (CWM). This site is not suspected of containing CWM. However, during conventional MEC operations, if the contractor identifies or suspects CWM, the contractor shall immediately withdraw upwind from the work area and contact the United States Army Engineering and Support Center Huntsville (USAESCH) Ordnance and Explosives (OE) Safety Office. The contractor shall secure the area and shall provide two personnel located upwind of the suspect CWM to secure the site until relieved by the Technical Escort Unit (TEU) or Explosive Ordnance Disposal (EOD) personnel.

3.0 SPECIFIC REQUIREMENTS.

The Government will perform Quality Assurance (QA) on all aspects of this task order. Any portion that fails QA will be redone at no cost to the Government. The Government will perform Quality Assurance based upon a Quality Assurance Surveillance Plan (QASP). The Government's final QASP will be developed based upon the Contractor's Quality Control Plan (QCP). The contractor shall propose payment milestones for the duration of this project. The payment milestones shall be based on Government acceptance of deliverables. The contractor shall submit the appropriate Quality Control (QC) documentation with each payment voucher and include the same information in the Final Report.

3.1 <u>(TASK 1) PROJECT PREPARATION AND PLANNING</u>:

This Task is not used.

3.2 (TASK 2) WORK PLAN (WP):

This Task is Firm Fixed Price.

3.2.1 The contractor shall prepare and submit for acceptance a WP in accordance with (IAW) DID MR-005-01. The Quality Control Plan shall be a detailed and comprehensive plan covering **all** aspects of the response. A property management plan will be required if the contractor has Government furnished equipment.

The contractor shall coordinate all field activities with FWS, DNER, the Municipality of Culebra, and landowners on procedures required to protect endangered species (floras and fauna).

3.3 (TASK 3) PERFORM COMMUNITY RELATIONS.

This task is time and materials

The contractor shall be prepared to provide support to the Community Relations activities as directed by ESCH and CESAJ Project Manger (PM) with input from the TPP process. For cost estimating purposes assume 10 one week meeting including travel and per diem to Culebra and vicinity. The contractor should include cost he deems necessary for Engineering, Administration and support.

3.4 (TASK 4) REMOVAL ACTION:

This task is time and materials

The Contractor shall provide the necessary personnel and equipment to safely destroy and/or remove and dispose of all MEC and munitions debris visible on the ground surface and IAW the Action Memorandum(s). The contractor shall use instrument aided searches to locate MEC and munitions debris in areas where vegetation could prevent him from seeing an object on the ground.

	SITE	**ACREAGE**
Task 4a	Mob - Demob	
Task 4b	OOU-3 Cerro Balcon	30
Task 4c	OOU-4 Isla Culebrita	82
Task 4d	OOU-5 Other surrounding Cays	39.5

3.4.1 SOW Performance Metrics and QC/QA Criteria

The performance metrics that will be used to evaluate the Contractor's performance of all tasks under this PWS are specified in Attachment B.

3.4.2 Backfilling Excavations: All access/excavation/detonation holes shall be backfilled by the Contractor. The Contractor shall restore such areas to their prior condition.

3.4.3 MEC Accountability: The Contractor shall maintain a detailed accounting of all MEC items/components encountered. This accounting shall include the amounts of MEC, the identification, condition, depth, disposition, and location. This accounting shall be a part of an appendix to the Final Report.

3.4.4 Disposal of Munitions Debris: All munitions debris shall be handled in accordance with Attachment A of the SOW.

3.4.5 Munitions Debris certification and verification: In the event a USACE Safety Specialist is not on site to verify the scrap the UXOQCS or UXOSO shall verify the scrap in accordance with Attachment A of the SOW.

3.4.6 QC/QA Performance Criteria

If the QA finds any of the items on the sites listed below while performing their QA check, the contractor will fail his performance criteria for this item of work and will be required to redo his work at no additional cost to the Government.

OOU-3 Cerro Balcon No explosive hazards or MEC objects with a width (diameter) or thickness inclusive of MK 23 and larger.

OOU-4 Isla Culebrita No explosive hazards or MEC objects with a width (diameter) or thickness of a 20mm and larger.

OOU-5 Surrounding Cays No explosive hazards or MEC objects with a width (diameter) or thickness of a 3 inch Navy Gun Fired projectile and larger.

3.5 <u>(TASK 5) GEOSPATIAL DATA – GIS:</u>

This Task is not used. The contractor is providing the GIS under a previous contract. The WP will be developed using previous GIS data and will intergrate the government furnished 3001 Geospatial aerial photography data to include orthomosaics, Geo TIFF's, SIDs, Metsdata tiles, etc. The specific areas of work will be presented in the WP in such a manner to allow easy verification of specific areas were removal actions will occur. This will allow the identification of difficult terrain and vegetation data. The Pre-Draft WP should be developed will be field verified by ESCH, CESAJ PM and PREQB before submitting the Draft WP to the public.

3.6 <u>(TASK 6) FINAL REPORT</u>:

This Task is not used. The contractor is providing a Pre-draft, Draft and Final Report under a previous contract.

3.7 <u>(TASK 7) ENVIRONMENTAL SAMPLING:</u>

3.7.1 The Environmental Sampling and Analysis Plan (SAP) shall be prepared in accordance with OE-005-10.01 and EM 200-1-3. The Sampling and Analysis Plan shall include a Field Sampling Plan and the Quality Assurance Project Plan to characterize the areas of interest. Previously prepared work plans for the this site shall be utilized as much as possible in the preparation of the plan. As a minimum, the level of data quality and QC shall be equivalent to that required in the existing work plans. The plan shall address each requirement as identified in ER 1110-1-263 and EM 200-1-3. The Contractor shall provide the laboratory QA/QC plan as an appendix to the SAP. The laboratory shall meet all of the requirements of Appendix I in EM 200-1-3 unless approved in advance in the SAP. If there are any requirements that the laboratory cannot meet, they shall be clearly identified in the SAP. The requirement for the laboratory to provide quantitative second column confirmation for explosives per EM 200-1-3/SW8000B (i.e., five-point calibrations must be performed for each target analyte for the primary and confirmatory columns and quantitative results for each column must be reported) will not be waived. Based upon project requirements, exceptions will be considered for the following coeluting pairs: 2-A-DNT/4-A-DNT, 2-NT/4-NT, and 2,4-DNT/2,6-DNT.

3.7.2 <u>Laboratory Qualifications.</u> The analytical laboratory utilized by the Contractor must be identified in the proposal and the SAP, have a current validation by the Corps of Engineers' Hazardous, Toxic, and Radioactive Center of Expertise (HTRW-CX), per EM 200-1-1 *Validation of Chemistry Laboratories,* 01 Jul 94, or be in compliance with the recently published version of the DOD Quality Systems Manual (QSM) including the NELAC chapter 5 component for the appropriate fields of testing, and hold the applicable state certifications to perform the analytical methods required by this SOW. Any laboratory performing chemical analysis must be approved prior to beginning work by CEHNC. The determination of acceptability of the laboratory will be at the discretion of the CEHNC Project Chemist and coordinated with the CEHNC Project Manager and CEHNC Technical Manager. If the laboratory fails to meet project-specific requirements at any time, the Contracting Officer may request use of the laboratory be discontinued and analytical services be procured from a laboratory that can meet project-specific requirements. Samples may not be subcontracted to another laboratory without the approval of the Contracting Officer, and the second laboratory must be validated by USACE for the parameters of concern.

3.7.3 Coordination with Government QA Laboratory. The Contractor must provide coordination for the collection and shipment of the QA samples. QA samples will be collected from 10% of the total quantity of samples. From the location that is chosen for QA analysis, the quantity of material collected shall be sufficient for three samples. The first two portions shall be submitted to the primary lab as the primary sample and the blind duplicate. The third portion shall be submitted to the QA laboratory as a split sample for analysis. All samples shall be thoroughly homogenized prior to placement into the sample containers. QA samples shall be sent to the government lab shown below by overnight delivery. The samples shall be analyzed by the same methods as the primary samples and shall be used to compare the primary and QA data. Sampling containers will be provided by the primary contracting laboratory for the QA samples at no additional costs to the government. The Contractor shall provide the QA lab a minimum of two weeks notice of sample shipment, unless an alternate notification requirement is proposed and accepted by the Contracting Officer. All QA sample handling and custody requirements shall be administered by the Contractor similar to the environmental samples. The QA laboratory address is:

U.S. Army Corps of Engineers
Environmental Chemistry Branch Laboratory (ECB)
ATTN: Laura Percifield
420 South 18th Street
Omaha, NE 68102
Telephone: (402) 444-4314

The Contractor shall be responsible for inscribing the Project ID "LIMS #" onto the labels and chain-of-custody records for all GQA samples shipped to ECB Lab. The Contractor shall coordinate with the CEHNC Project Chemist to acquire a LIMS #. Contractor laboratory data, to include results of the parent samples, field control samples and associated laboratory QC shall be provided to the QA lab and USAESCH per the submittal schedule for QA evaluation.

3.7.4 Data Reporting Requirements. The Contractor shall provide data reporting elements for definitive data per Section I.13.4.2 of EM 200-1-3. The laboratory shall report all analytical results greater than the Method Detection Limit (MDL), which, in the analyst's professional judgment, are believed to be reliably detected. Concentrations reported between the MDL and the Practical Quantitation Limit (PQL) shall be flagged as estimated. PQLs shall be at least 3 times MDLs for all analytes.

The data shall be assembled in a package so that USEPA could validate the data in accordance with USEPA requirements. The data shall also be included in the draft and final reports in tabular format. There should be, at a minimum, two types of data tables. The first shall include all analytical results for all samples collected. The second shall include all analytical results greater than Method Detection Limit (MDL) for all samples collected. Tables should be sorted by method and include appropriate data flags resulting from laboratory review and from Contractor's data validation.

Data shall also be provided electronically by the Contractor in the ADR format. Use of this software will require that the contractor develop a comprehensive library file for all of the methods to be analyzed under this SOW. The library file will accurately reflect all of the analytical quality requirements as documented in the final SAP for this project and will be provided to both USACE and the sub-contract lab for use in screening EDD submittals. All electronic data submitted by the contract laboratory is required to be error-free, and in complete agreement with the hardcopy data. Data files are to be delivered both by e-mail and on high density CD accompanying the hardcopy data reports. The disk must be submitted with a transmittal letter from the laboratory that certifies that the file is in agreement with hardcopy data reports and has been found to be free of errors using the latest version of the ADR evaluation software provided to the laboratory. The contract laboratory, at their cost, will correct any errors identified by CEHNC. The Contractor is responsible for the successful electronic transmission of field and laboratory data under this SOW. The Contractor's laboratory is responsible for archiving the electronic raw data and sufficient associated hardcopy data (e.g., sample login sheets and sample preparation log sheets) to completely reconstruct the analyses that were performed for a period of ten years after completion of this contract.

3.7.5 Data Validation. All data collected and produced as a result of this field and laboratory effort shall be validated by the contractor per the as requirements in approved SAP and the *USEPA Contract Laboratory Program (CLP) National Functional Guidelines (NFG) for Inorganic data Review* EPA 540-R-01-008 dated July 2002 and the USEPA *CLP NFG for Organic data Review* dated October 1999. The validation shall be performed and documented in the draft and final engineering reports. Validation documentation should address review of laboratory and field QC results. Persons performing the data validation shall have a minimum of 10 years experience plus directly relatable laboratory experience coupled with two years data review and two years data validation experience in accordance with current guidelines.

3.7.6 Data Quality The Contractor shall provide a data quality of a level sufficient for the support project objectives as defined in the SAP. The Contractor shall provide QC of the various analytical tasks performed. The Contractor is responsible for achieving the data quality as defined in the SAP. Analytical data that does not meet QA requirements may be rejected by the Government and contract re-performance required at no additional cost to the Government.

3.7.7 Environmental Sampling. When suspected MEC is identified at these locations a pre and post detonation composite sample shall be collected For cost estimating purposes, assume 50 total samples shall be priced. Refer to EM 200-1-3, E3 for guidance on the correct procedure for the collection of composite samples. Each pre and post detonation sample shall be analyzed for TAL metals by method SW846 3050B/6010B, explosives by method 8330 perchlorate, PETN, and NG. The contractor shall propose an EPA approved method for the analysis of PETN, & NG. All samples locations shall be accurately recorded using GPS coordinates to within one (1) foot of the actual sample location. These sample locations shall be plotted on a map for this project.

3.7.2 Submittals for this task shall include Daily Quality Control Reports (DQCRs), Chain of custody forms (COC), submittal and evaluation of all associated QC information, maps showing the OB/OD pre and post sampling locations and analytical concentrations at each location. The contractor shall submit the laboratory data submitted in an electronic ADR format. Use of this software will require that the contractor develop a comprehensive library file for all of the methods to be analyzed under this SOW. The library file and will be provided to both USACE and the sub-contract lab for use in screening EDD submittals. All electronic data submitted by the contract laboratory is required to be error-free, and in complete agreement with the hardcopy data. Data files are to be delivered both by e-mail and CD accompanying the hardcopy data reports. The disk must be submitted with a transmittal letter from the laboratory that certifies that the file is in agreement with hardcopy data reports and has been found

4.0 SUBMITTALS AND CORRESPONDENCE:

4.1 Schedule: The Contractor shall submit a proposed Project Schedule in Microsoft Project. The Contractor shall update the schedule in accordance with DID MR-085 Project Status Report. A final schedule shall be submitted a minimum of 30 days before commencing fieldwork.

4.2 Telephone Conversations/Correspondence Records: The Contractor shall keep a record of each phone conversation and written correspondence concerning this Task Order in accordance with DID MR-055. A copy of this record shall be attached to the Project Status Report.

4.3 Project Status Reports: The Contractor shall prepare and submit Project Status Reports in accordance with DID MR-085 and include any other items required in the PWS.

4.4 Computer Files: All final text files generated by the Contractor under this contract shall be furnished to the Contracting Officer in Microsoft Word 98 or higher software. Spreadsheets shall be in Microsoft EXCEL. All final CADD drawings shall be in Microstation 95 or higher. All GIS data shall be in ESRI (Arcview/Arcinfo) format. All CADD and GIS submittals shall be IAW DID MR 005-07.

4.5 PDF Deliverables: In addition to the paper and digital copies of submittals, the final version of any and all reports and/or plans shall be submitted, uncompressed, on CD ROM in PDF format along with a linked table of contents, linked tables, linked photographs, linked graphs, and linked figures, all of which shall be suitable for viewing on the Internet. The PDF files shall be created from source documents whenever possible.

4.6 <u>Identification of Responsible Personnel</u>: Each report shall identify the specific members and title of the Contractor's staff and subcontractors that had significant and specific input into the reports' preparation or review.

4.7 <u>Public Affairs</u>: The Contractor shall not publicly disclose any data generated or reviewed under this contract. The Contractor shall refer all requests for information concerning site conditions to the CESAJ Antilles Public Affairs Office or the CESAJ PM. with a copy furnished to the USAESCH PM. Reports and data generated under this contract are the property of the DoD and distribution to any other source by the Contractor, unless authorized by the Contracting Officer, is prohibited.

4.8 <u>Submittals</u>: The Contractor shall furnish copies of the plans, maps, and reports as identified in paragraph 4.9, or as specified in this PWS, to each addressee listed below in the quantities indicated. The Contractor shall submit an equal number of CDs and hard copies (draft and final versions) IAW section 4.4. The Contractor shall submit an equal number of CDs and hard copies, of all final versions, IAW section 4.5. For purposes of the PWS all days are considered calendar days. The contractor may submit the CDs of the final version after the hard copy final version has been accepted.

4.9 <u>Copies Furnished:</u>

ADDRESSEE	**COPIES**
US Army Engineering and Support Center, Huntsville ATTN: CEHNC-OE-DC (Mr. Terry Steuart) 4820 University Square Huntsville, AL 35816-1822	4
US Army Engineer District, Jacksonville ATTN: CESAJ-DP--B (Mr. Robert Bridgers) 701 San Marco Blvd Jacksonville, FL 32207	5
US Army Corp of Engineers Antilles Area Office ATTN: CESAJ-DS-P (Jose Martinez-Laboy) 400 Fernandez Juncos Avenue San Juan P.R. 00901-3299	25

4.10 Submittals and Due Dates:

SUBMITTAL	DUE DATES
Proposed Schedule	5 days after award
Pre Draft Work Plan	21 days after award
Draft Work Plan	14days after receipt of comments
Final Work Plan	14 days after receipt of comments

The overall completion date for all work associated with this contract is 30 September 2006

5.0 REFERENCES:

5.1 Section C of the Basic Contract

ATTACHEMENT A

USESCH **9 March 05**

Corps of Engineers Contractors Ordnance and Explosive (OE) , Range Residue (RR) Inspection, Certification, and Final Disposition Procedures

I. OE & RR Inspection – Contractor Responsibilities and Procedures

1. The U.S. Army Corps of Engineers (USACE) contractors executing projects will comply with the following procedures for processing OE and Range Residue for final disposition as scrap metal. The objective of these procedures is to ensure that an inspection procedure of the exterior and interior surfaces of all recovered items is in place to ensure these items do not present an explosive hazard. These USACE contractor responsibilities and procedures will be contained in the project work plan.

a. Unexploded Ordnance (UXO) Sweep Personnel will only mark suspected items and will not be allowed to perform any assessment of a suspect item to determine its status.
b. Unexploded Ordnance (UXO) Tech I will only tentatively identify a located item as scrap or OE.
c. UXO Technician II will:

(1) Inspect each item as it is recovered and determine the following:

♦ ♦ Is the item a UXO or a component of a military munitions?

♦ ♦ Does the item contain explosives hazards or other dangerous fillers?

♦ ♦ Does the item require detonation?

♦ ♦ Does the item require demilitarization (demil) or venting to expose other dangerous fillers?

♦ ♦ Does the item require draining of engine fluids, illuminating dials and other visible liquid hazardous, toxic or radiological waste (HTRW) materials?

(2) Segregate items requiring demil or venting procedures from those items ready for certification.

(3) Items found to contain explosives hazards or other dangerous fillers will be processed in accordance with applicable procedures.

d. UXO Technician III will:

(1) Inspect recovered items to determine if free of explosives hazards or other dangerous fillers and engine fluids, illuminating dials and other visible liquid HTRW materials?

(2) Supervise detonation of items found to contain explosive hazards or other dangerous fillers and venting/demil procedures.

(3) Supervise the consolidation of recovered scrap metal for containerization and sealing.

e. UXO Quality Control (QC) Specialist will:

(1) Conduct daily audits of the procedures used by UXO teams and individuals for processing OE or Range Residue.

(2) Perform and document, a minimum 10%, random sampling (by pieces, volume or area) of all scrap metal collected from the various teams to ensure no items with explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials are identified as scrap metal as required for completion of the Requisition and Turn-in Document, DD Form 1348-1A.

f. UXO Site Safety Officer (UXOSO) will:

(1) Ensure the specific procedures and responsibilities for processing OE and Range Residue for certification as scrap metal is being followed, performed safely, consistent with applicable regulations, and in accordance with the USACE approved project work plan.

(2) Will perform random checks of processed OE and Range Residue to ensure items being identified as scrap are free from any explosive hazards engine fluids, illuminating dials and other visible liquid HTWR materials.

g. Senior UXO Supervisor will:

(1) Be responsible for ensuring work and Quality Control (QC) Plans specify the procedures and responsibilities for processing OE and Range Residue for the final disposition as scrap metal.

(2) Ensure a Requisition and Turn-in Document, DD Form 1348-1A is completed for all scrap metal to be transferred for final disposition.

(3) Perform random checks to satisfy that the OE or range residue is free from explosive hazards necessary to complete the Form, DD 1348-1A.

(4) Certify all scrap metal generated from OE or Range Residue as free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTWR materials.

(5) Be responsible for ensuring that these inspected materials are secured in a closed, labeled and sealed container and documented as follows;

- The container will be closed and clearly labeled on the outside with the following information: The first container will be labeled with a unique identification that will start with **USACE/Installation Name/Contractor's Name/0001/Seal's unique identification** and continue sequentially.

- The container will be closed in such a manner that a seal must be broken in order to open the container. A seal will bear the same unique identification number as the container or the container will be clearly marked with the seal's identification if different from the container.

- A documented description of the container will be provide by the contractor with the following information for each container; contents, weight of container; location where OE scrap was obtained; name of contractor, names of certifying and verifying individuals; unique container identification; and seal identification, if required (see paragraph I. 1.g. (5). The contractor in a separate section of the final report will also provide these documents.

II. OE Scrap Certification and Verification

1. The contractor will ensure that scrap metal generated from OE or Range Clearance is properly inspected in accordance with the procedures in I. above. Only personnel who are qualified UXO personnel per USACE's Contract Data Item Description (DID) OE-025 will perform these inspections. The Senior UXO Supervisor will certify and the USACE's OE Safety Specialist will verify that the scrap metal is free of explosive hazards.

2. DD form 1348-1A will be used as certification/verification documentation. All DD 1348-1A must clearly show the typed or printed names of the contractor's Senior UXO Supervisor and the USACE's OE Safety Specialist, organization, signature, and contractor's home office and field office phone number(s) of the persons certifying and verifying the scrap metal.

   a. Local directives and agreements may supplement these procedures. Coordination with the local concerns will identify any desired or requested supplementation to these procedures.

   b. In addition to the data elements required and any locally agreed to directives, the DD 1348-1A must clearly indicate the following for scrap metal:

(1) Basic material content (Type of metal; e.g., steel or mixed)

(2) Estimated weight

(3) Unique identification of each of the containers and seals stated as being turned over.

(4) Location where OE scrap was obtained.

(5) Seal identification, if different from the unique identification of the sealed container.

c. The following certification/verification will be entered on each DD 1348-1A for turn over of scrap and will be signed by the Senior UXO Supervisor and the USACE OE Safety Specialist.

"This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards, engine fluids, illuminating dials and other visible liquid HTRW materials.

III Maintaining The Chain Of Custody And Final Disposition

The contractor, in coordination with the Corps of Engineers, will arrange for maintaining the chain of custody and final disposition of the certified and verified materials. The certified and verified material will only be released to an organization that will:

a. Upon receiving the unopened labeled containers each with its unique identified and unbroken seal ensuring a continued chained of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreeing with the provided documentation that the sealed containers contained no explosive hazards when received. This will be signed on company letterhead and stating that the contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted, shredded, or flashed and are only identifiable by their basic content.

b. Send notification and supporting documentation to the sealed container-generating contractor documenting the contents of the sealed containers have been smelted or shredded and are now only identifiable by their basic content.

c. This document will be incorporated by the contractor into the final report as documentation for supporting the final disposition of this scrap metal.

Attachment B

QASP Performance Metrics for Performance Assessment Record (PAR)

	Exceptional	Very Good	Satisfactory	Marginal	Unsatisfactory
PAR Category: Quality of Product or Service					
Performance indicator: Document reviews					
Draft Plans and Reports	All contract-milestone documents approved as submitted	One or more documents or subplans were approved as submitted, but exceptions were noted. Resubmissions were not required.	One or more documents or subplans required revisions to be resubmitted for approval prior to proceeding. Resubmission of an entire document or subplan was not required.	One or more documents or subplans required revisions to be resubmitted for approval prior to proceeding. Resubmission of an entire document or subplan was required.	One or more documents or subplans did not comply with contract requirements, or one or more documents or subplans required more than one resubmission of the entire document or subplan prior to its approval.
Performance indicator: Project Execution					
Process Compliance	Zero Corrective Action Requests (CAR)	1-5 CARs for non-critical WP violations (no impact to overall cost and schedule resulting from the non-compliance)	6 or more CARS for non-critical violations (no impact to overall cost and schedule resulting from the non-compliance)	>1 CAR where non-compliance adversely impacted overall cost or schedule	Repeated non-compliance with WP requirements resulted in cost overruns or repeated schedule extensions
Quality Control	Zero QA failures, 80% or more QC measures accepted, zero repetitive QC failures	Zero QA failures, 80% or more QC measures accepted, one or more repetitive QC failure occurred	Zero QA failures, less than 80% of QC measures accepted, or, One or more non-repetitive QA failures occurred	1-3 repetitive QA failures occurred	>3 repetitive QA failures occurred
PAR Category: Schedule					
Performance indicator: Timely completion of tasks					
Final Work Plans and Reports, project milestones, T.O. invoices	All document submittals and task order milestones and invoices complete and approved by T.O date, project closed out/final invoice approved	Project closed out/final invoice approved ahead of schedule	project closed out/final invoice approved on T.O. date	Project closed out/final invoice approved within 30 calendar days after T.O. date.	Project closed out/final invoice approved more than 30 calendar days after T.O. date.

	ahead of schedule				
Monthly/weekly status reports accurate/on-time			Yes		No
Performance indicator: Impacts to schedule					
Impacts caused by contractor or other causes identified, in writing, in a timely manner to apply acceptable corrective actions.			Yes		No
PAR Category: Cost Control					
Performance indicator: No unauthorized cost overruns					
Unauthorized cost overruns			No		Yes
Total Project Costs	Total contract invoices less than 98% of initial T.O. authorized amount	Total contract invoices greater than 98% but less than 99.99%of initial T.O. authorized amount	Total contract invoices between 99.99% and 100% of initial T.O. authorized amount	Total contract invoices greater than 100% but less than 105% of initial T.O. authorized amount	Total contract invoices greater than or equal to 105% of T.O. authorized amount
Performance indicator: Monthly cost report					
Monthly cost reports accurate			Yes		No
Performance indicator: Impacts to cost					
Impacts caused by contractor or other causes identified, in writing, in a timely manner to apply acceptable corrective actions.			Yes		No
PAR Category: Business Relations					
Performance indicator: Met contractual obligations					
Corrective Actions taken were timely and effective (Refer to CARs issued to contractor)			Yes		No
Performance indicator: Professional and Ethical Conduct					
Meetings and correspondences with	Zero letters of reprimand,		Zero letters of reprimand,	One letter of reprimand,	More than one letter of reprimand, grievance or

Public, project delivery team and other stakeholders	grievances, or formal complaints AND one or more unsolicited letters of commendation		grievances, or formal complaints	grievance or formal complaint that was resolved through negotiation	formal complaint that were resolved through negotiation OR removal of one or more project personnel as a results of a letter of reprimand, grievance or formal complaint.
Performance indicator: Customer has overall satisfaction with work performed					
Customer survey results for rating period	4.0-5.0	3.0-3.9	2.0-2.9	1.0-1.9	<1.0
Performance indicator: Personnel responsive and cooperative					
Key personnel responsive, and cooperative	Always		Most Times		Almost Never
PAR Category: Management of Key Personnel and Resources					
Performance indicator: Personnel knowledgeable and effective in their areas of responsibility					
Personnel assigned to tasks	All personnel proposed by contractor were assigned to project, some personnel were substituted by higher qualified individuals.		All personnel proposed by contractor were assigned to project, some personnel were substituted by equally qualified individuals.		All personnel proposed by contractor were assigned to project, some personnel were substituted by lesser qualified individuals.
Performance indicator: Personnel able to manage resources efficiently					
Instances when resource management had negative impact on project execution	0	1-2	3-4	5-6	>6
PAR Category: Safety					
Performance indicator: Accidents and Violations					
Number of Class A Accidents, contractor at fault	0				1 or more
Major safety violations	0		1		>1
Minor safety violations	1		2-4		>4

The following guidelines are provided for issuing ratings that are subjective in nature, these ratings will be supported by the weight of evidence documented during the government's surveillance efforts:

Exceptional: Performance *meets* contractual requirements and *exceeds many* to the Government's benefit. The contractual performance of the element or sub-element being assessed was accomplished with *few minor problems* for which corrective actions taken by the contractor were *highly effective*.

Very Good: Performance *meets* contractual requirements and *exceeds some* to the Government's benefit. The contractual performance of the element or sub-element being assessed was accomplished with *some minor problems* for which corrective actions taken by the contractor were *effective*.

Satisfactory: Performance *meets* contractual requirements. The contractual performance of the element or sub-element contains *some minor problems* for which corrective actions taken by the contractor *appear or were satisfactory*.

Marginal: Performance *does not meet all* contractual requirements. The contractual performance of the element or sub-element being assessed reflects a *serious problem* for which the contractor has *not yet identified corrective actions*. The contractor's proposed actions appear only *marginally effective or were not fully implemented*.

Unsatisfactory: Performance *does not meet most* contractual requirements and *recovery is not likely* in a timely manner. The contractual performance of the element or sub-element contains *serious problems* for which the contractor's corrective actions *appear or were ineffective.*

PRELIMINARY POINTS OF AGREEMENT
BETWEEN
THE DEPARTMENT OF THE ARMY
AND
THE PUERTO RICO ENVIRONMENTAL QUALITY BOARD

Investigation and Response Activities Related to Contamination Resulting From Military Use and Training In Areas On and Around Culebra, Puerto Rico

ARTICLE I – PURPOSE

The U.S. Department of the Army ("Army") and the Puerto Rico Environmental Quality Board ("PREQB") (hereinafter the "Parties") enter into this Preliminary Points of Agreement to foster a cooperative relationship and to facilitate current and future discussions regarding investigations and response activities related to contamination resulting from military use and training in areas on and around Culebra, Puerto Rico.

ARTICLE II – BACKGROUND

WHEREAS, Culebra is located 17 miles east of the island of Puerto Rico and is approximately nine miles from the Island of Vieques. In 1901, Culebra's public lands were placed under Department of the Navy ("Navy") control. In accordance with current information, the Navy used certain areas of Culebra for training activities from 1903 until 1941, and as a bombing and gunnery range from 1935 until 1975.

WHEREAS, unexploded ordnance and remnants of exploded ordnance and other contaminants resulting from military use and training may be present on Culebra, the keys (cays and small islands) of Culebra, and in the nearby and surrounding water areas. The Commonwealth of Puerto Rico believes that if the presence of these substances is not properly characterized, and response actions taken where appropriate, they may pose an unreasonable risk or threat to human health and the environment.

WHEREAS, in 1974, Congress enacted "Notwithstanding any other provision of law, the present bombardment area on the island of Culebra shall not be utilized for any purpose that would require decontamination at the expense of the United States. Any lands sold, transferred, or otherwise disposed of by the United States as a result of the relocation of the operations referred to in subsection (a) may be sold, transferred, or otherwise disposed of only for public park or public recreational purposes." Section 204(c) of the Military Construction Authorization Act of 1974, Pub.L. 93-166.

WHEREAS, in 1980, subsequent to the 1974 Authorization Act, Congress enacted the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"). CERCLA imposes liability on "the owner and operator of a vessel or a facility" and on "any person who at the time of disposal of any hazardous substance owned or operated any facility at which such hazardous substances were disposed of[.]" 42 U.S.C. §9607(a)(1) - (2). The term "person" includes "an individual, firm, corporation, association, partnership, consortium, joint venture, commercial entity, United States Government, State [including the Commonwealth of Puerto Rico], municipality, commission, political subdivision of a State, or any interstate body." 42 U.S.C. §9601(21) and (27). CERCLA 120(a) requires that each department, agency, and instrumentality of the United States shall be subject to, and comply with, CERCLA. 42 U.S.C. §9620(a).

WHEREAS, in 1992, subsequent to the 1974 Authorization Act, Congress enacted "Each department, agency, and instrumentality ... of the Federal Government (1) having jurisdiction over any solid waste management facility or disposal site, or (2) engaged in any activity resulting, or which may result, in the disposal or management of solid waste or hazardous waste shall be subject to, and comply with, all Federal, State, interstate, and local requirements, both substantive and procedural (including any requirement for permits or reporting or any provisions for injunctive relief and such sanctions as may be imposed by a court to enforce such relief), respecting control and abatement or solid waste or hazardous waste disposal and management in the same manner, and to the same extent, as any person is subject to such requirements[.]" 42 U.S.C. §6961(a).

WHEREAS, in the early 1980s, the Navy transferred certain Culebra parcels to the Secretary of the Interior. In 1982, the Secretary of the Interior deeded some of these parcels to the Commonwealth of Puerto Rico. Section 9 of the Quitclaim Deed from the United States to the Commonwealth states: "In accordance with the provisions of Section 204 of Public Law 93-166, that portion of the subject property which has heretofore been used as a bombardment area by the United States Navy is hereby accepted by Grantee in its present condition and further agrees that the United States shall not in any manner be responsible for decontamination of such area, nor for the costs thereof, but the same is and shall be solely (sic) the responsibility of the Grantee. The Grantee hereby agrees to indemnify and save the Grantor harmless from any and all claims, demands, actions, liabilities, judgments, costs and attorney's fees arising out of, claimed on account of or in any manner predicated upon loss or damage to property or injuries to or the death of any and all persons whatsoever, arising in any way from any person's use of or presence on the subject property."

WHEREAS, in 1986, CERCLA was amended to state that "there shall be no liability under subsection (a) of this section [42 U.S.C. §9607] for a person otherwise liable who can establish by a preponderance of the evidence that the release or threat of release of a hazardous substance and the damages resulting there from were caused solely by -- ... (3) an act or omission of a third party other than an employee or agent of the defendant, or than one whose act or omission occurs in connection with a contractual relationship, existing directly or indirectly, with the defendant (except where the sole contractual arrangement arises from a published tariff or acceptance for carriage by a common carrier by rail), if the defendant establishes by a preponderance of the evidence that (a) he exercised due care with respect to the hazardous substance concerned, taking into consideration the characteristics of such hazardous substance, in light of all relevant facts and circumstances, and (b) he took precautions against foreseeable acts or omissions of any such third party and the consequences that could foreseeably result from such acts or omissions ...." 42 U.S.C. §9607(b).

WHEREAS, in 1986, CERCLA was also amended to state that "the term 'contractual relationship,' for the purpose of 9607(b)(3) of this title, includes, but is not limited to, land contracts, deeds, easements, leases, or other instruments transferring title or possession, unless the real property on which the facility concerned is located was acquired by the defendant after the disposal or placement of the hazardous substance on, in, or at the facility, and one or more of the circumstances described in clause (i), (ii), or (iii) is also established by the defendant by a preponderance of the evidence: (i) At the time the defendant acquired the facility the defendant did not know and had no reason to know that any hazardous substance which is the subject of the release or threatened release was disposed of on, in, or at the facility .... In addition to establishing the foregoing, the defendant must establish that the defendant has satisfied the requirements of section 9607(b)(3)(a) and (b) of this title, provides full cooperation, assistance, and facility access to the persons that are authorized to conduct response actions at the facility (including the cooperation and access necessary for the installation, integrity, operation, and maintenance of any complete or partial response action at the facility), is in compliance with any land use restrictions established or relied on in connection with the response action at a facility, and does not impede the effectiveness or integrity of any institutional control employed at the facility in connection with a response action." 42 U.S.C. §9601(35).

WHEREAS, CERCLA provides that: "(1) No indemnification, hold harmless, or similar agreement or conveyance shall be effective to transfer from the owner or operator of any vessel or facility or from any person who may be liable for a release or threat of release under this section, to any other person the liability imposed under this section. Nothing in this subsection shall bar any agreement to insure, hold harmless, or indemnify a party to such agreement for any liability under this section." 42 U.S.C. 9607(e)(1).

WHEREAS, the Parties do not necessarily agree with the interpretation, application to the present situation, and/or legal significance of the foregoing legal provisions. Furthermore, the Parties willingly enter into this agreement without renouncing or disclaiming any legal or factual claims they may have and may invoke them at a later time or action if no agreement can be reached.

WHEREAS, despite their legal differences, the Parties desire to investigate and to take appropriate response actions to respond to threats to public health and the environment resulting from past military activities on Culebra.

WHEREAS, as a former Navy facility "under the jurisdiction of the Secretary and owned by, leased to, or otherwise possessed by the United States at the time of actions leading to contamination," portions of Culebra have been determined to be eligible for inclusion in the Department of Defense Formerly Used Defense Sittes ("FUDS") Program (See 10 U.S.C. § 2701(c)(1)(A-B); 10 U.S.C. §2703). In coordination with the Commonwealth, the Army has been involved since 1991 in performing investigations related to Navy training activities on the island of Culebra and surrounding cays. As described in the Draft Outline Army Plan of Action for Culebra, the Army has already conducted inspections of many Culebra areas previously used by the Navy for training, and has completed an initial report to identify areas for further investigation. The Department of the Army is the Executive Agent for the FUDS Program and, through the U.S. Army Corps of Engineers, executes the FUDS Program in accordance with CERCLA and the National Contingency Plan ("NCP").

WHEREAS, today, several non-Department of Defense entities, including the United States, acting through the U.S. Fish and Wildlife Service; the Culebra Conservation and Development Authority; and private landowners own areas on and around Culebra.

WHEREAS, after discussions with the Commonwealth and U.S. Environmental Protection Agency (EPA) on the appropriateness and necessity of the listing, Army has drafted an "Outline of Army Plan of Action for Culebra," which is attached to this Preliminary Points of Agreement.

WHEREAS the Commonwealth of Puerto Rico and PREQB appreciate and acknowledge the Army's "Outline of Army Plan of Action for Culebra" as a positive first step forward.

WHEREAS, on 13 June 2003, the Governor of Puerto Rico requested that EPA include certain "lands and bodies of water on Vieques and Culebra," which the Commonwealth has identified collectively as the Atlantic Fleet Weapons Training Area ("AFWTA"), as Puerto Rico's single highest priority site for purposes of listing on the National Priorities List (NPL) pursuant to CERCLA §105(a)(8)(B). By letters dated October 21, 2003, May 26, 2004 and July 28, 2004, Puerto Rico provided a more specific description of the lands and waters proposed for listing.

WHEREAS, on August 13, 2004, EPA published a notice of a proposal to add to the NPL certain areas on and around Vieques and Culebra, which the Commonwealth has identified collectively in its listing request as the AFWTA, the Commonwealth's single highest priority site. In the notice, EPA solicited "comment on an approach that would separate the final listing decision for Culebra from the final listing decision for Vieques. Under such an approach, EPA would go forward with a final rule listing Vieques and postpone the final listing decision of Culebra to allow the completion of a Memorandum of Agreement between Puerto Rico and Army. The Memorandum of Agreement would govern the response actions necessary to protect Culebra's human health and environment. The EPA, Puerto Rico and the Army have agreed to pursue this alternate arrangement. The terms or progress under such agreement may determine the point at which it may be appropriate to withdraw the proposal to list the Culebra areas. EPA's intent would be to allow the Culebra areas to be addressed by the two parties under their agreement." 69 Fed. Reg. 50115, 50119 (August 13, 2004).

WHEREAS Puerto Rico is willing to withdraw or modify its request to include the Culebra area proposed for listing on the NPL at some point in the future if satisfactory progress is being made by other means toward investigating and responding to threats to human health and the environment from past military activities on Culebra on terms and conditions to be negotiated in the Memorandum of Agreement. If an agreement cannot be reached, Puerto Rico intends to request that the Culebra portions of the facility achieve the same NPL status as the Vieques portions.

ARTICLE III – SCOPE OF PRELIMINARY POINTS OF AGREEMENT

NOW, THEREFORE, the Parties have agreed to the following principles:

A. <u>Open Communications</u>. The Parties agree to cooperate with each other through an open and transparent process both with respect to communications with each other and with respect to communication with the public and other stakeholders. The Parties agree to raise and resolve issues at the Program Manager level. The Parties' signatories (or senior representatives) agree to meet as necessary, by telephone or in person, to address issues that cannot be resolved at lower levels. The Parties agree to resolve any conflicts using a consensus building approach to identify practical and effective solutions.

B. <u>Outline of Army Plan of Action for Culebra</u>. The Army has provided the "Outline of Army Plan of Action for Culebra" to the PREQB for review and comment. The Parties agree that the "Outline of Army Plan of Action for Culebra" provides a framework for defining the nature and scope of past, current, and future Army investigation and response activities on and around Culebra. The Parties agree to refine the Action Plan to achieve results that are legally permissible, technically feasible, consistent with explosives safety principles, protective of human health and the environment, and compliant with CERCLA and the NCP. The PREQB further agrees to provide its comments to the Army within 30 days following the signing of this Preliminary Points of Agreement by all Parties. The Parties agree to meet and discuss any issues, including revisions to the "Outline of Army Plan of Action for Culebra" based on ongoing investigations, as needed, thereafter.

C. <u>Document Sharing</u>. Throughout this effort, the Parties agree to share with each other any non-privileged documentation in their possession pertinent to the investigation and response activities related to contamination resulting from military use and training on or near Culebra. The Parties agree to provide any comments they might have on such documentation within a reasonable timeframe such as not to disrupt or delay unnecessarily the schedule for the work to be performed.

D. Additional Investigation and Response Activities. Pursuant to the revised Outline of Army Plan of Action for Culebra, and in accordance with CERCLA and the NCP, Army shall conduct investigations to determine the presence of contamination resulting from military use and training in Culebra areas that are eligible under the FUDS program. These areas, as well as the associated water areas, include, but are not necessarily limited to, the following:

1. Flamenco Peninsula (Northwest Peninsula);
2. Alcarraza Cay (Fungy Bowl);
3. Los Gemelos (Twin Rocks);
4. Cayo del Agua;
5. Culebrita (northwest section);
6. Cayo Geniqui (Palada Cay);
7. Cayo Tiburon (Shark Cay);
8. Cayo Botella (Ladrone Cay); and
9. Mortar Range Area in Cerro Balcon.

E. Parties Roles and Responsibilities. The Army recognizes the PREQB as the Lead Regulatory Agency and agrees to conduct response activities in accordance with CERCLA, the NCP, and applicable Puerto Rico law in those Culebra areas that are eligible under the FUDS program and to the extent authorized and not otherwise prohibited by law.

Army shall coordinate and perform its investigative and response activities under the oversight of the PREQB. If deemed necessary, the PREQB intends to utilize technical assistance from EPA. Nothing in this agreement may be interpreted as impeding EPA to provide whatever technical assistance is requested by PREQB in this process.

F. Memorandum of Agreement. The Parties contemplate that the PREQB and Army will enter into a Memorandum of Agreement to implement this Preliminary Points of Agreement. Specifically, the Memorandum of Agreement will provide for an open and transparent process; identification of legally permissible, technically feasible, safe, and protective objectives; establishment of realistic timelines and milestones to be negotiated during the final Memorandum of Agreement; formulation of reliable measures of merit; consideration of the Parties' respective roles and responsibilities; public and stakeholder participation; and a process for issue resolution. The Parties agree to use their best efforts to reach an agreement that effectively and efficiently deals with human health and environmental issues arising from contamination resulting from military use and training on Culebra and its surrounding keys and waters, and that focuses on results, including protecting public health and the environment from unreasonable risks, if any.

ARTICLE IV – ACCESS TO PROPERTIES

Activities pursuant to this Preliminary Points of Agreement will be carried out on property that is no longer under the jurisdiction of the Secretary of the Defense and is neither owned, leased to, nor otherwise possessed by the Department of Defense. This property is currently under the jurisdiction of the U.S. Fish and Wildlife Service, the Commonwealth, the Municipality of Culebra, or private landowners. In order to ensure the efficient progress of activities, the Parties agree to use their best efforts and available authorities to obtain access for Army to all applicable Culebra properties. The PREQB agrees to coordinate access to properties owned by the Commonwealth and/or the Municipality of Culebra. In the event that Army is unable to obtain access required for investigative or response activities, Army shall promptly notify the PREQB.

ARTICLE V – QUALIFICATIONS AND LIMITATIONS

This Preliminary Points of Agreement is neither a fiscal nor a funds obligation document.

Nothing in this Agreement is intended to alter the specific statutory or regulatory authorities or responsibilities possessed by any of the signatories, or of other non-signatory agencies or parties, including the inherent authority of the Parties and their successors, to exercise their prerogatives, including enforcement and regulatory authority.

The activities contemplated in this Preliminary Points of Agreement will be carried out in accordance with existing statutory authorities, obligations, and restrictions.

ARTICLE VI – EFFECTIVE DATE

This Preliminary Points of Agreement will be effective when approved by all of the indicated signatories. The Parties will continue to discuss and contemplate a final memorandum of agreement, which when final will supercede this document.

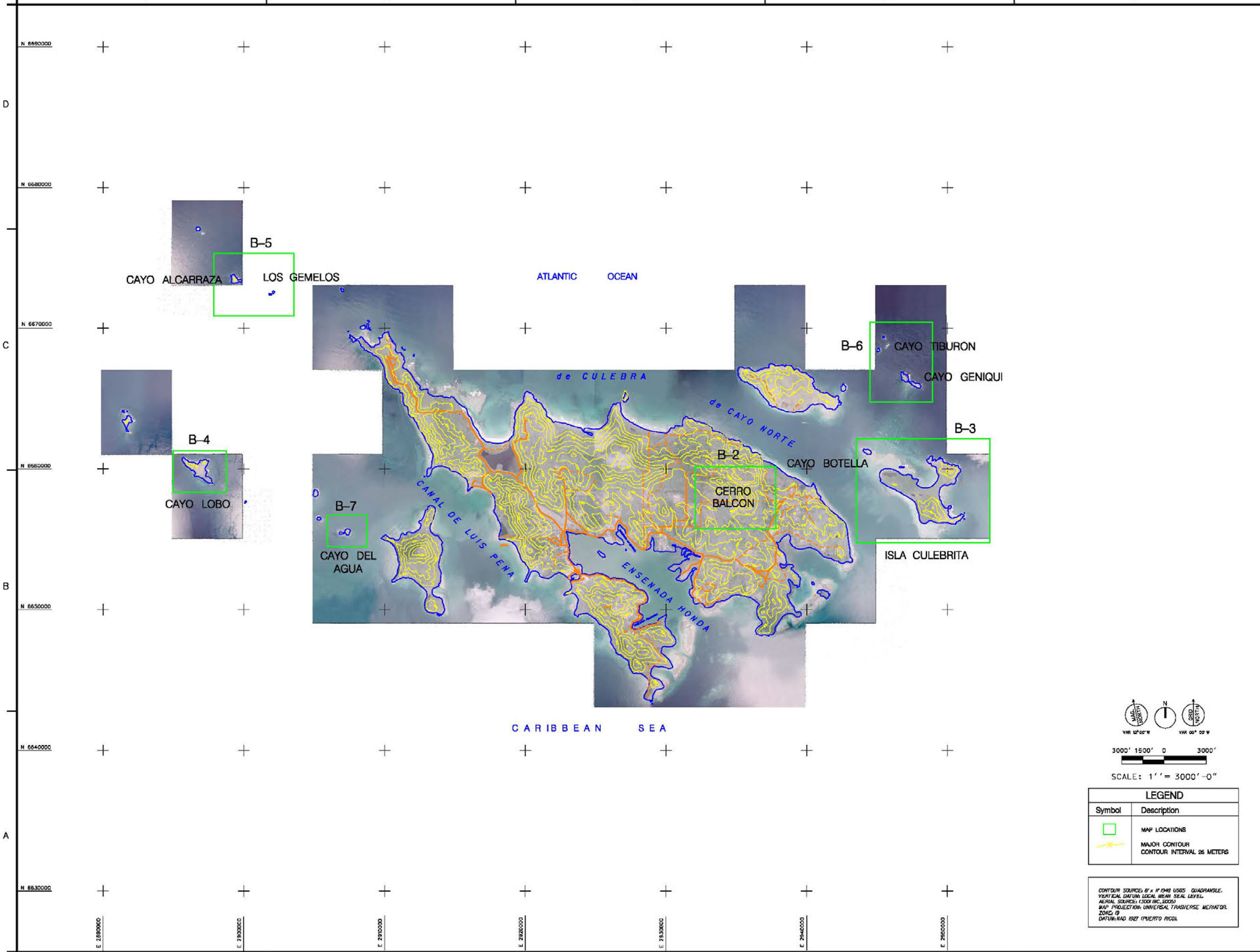
APPROVED: October 28, 2004

Raymond J. Fatz
Raymond J. Fatz
Deputy Assistant Secretary of the Army
(Environment, Safety and Occupational Health)

Esteban Mujica-Cotto
President, Environmental Quality Board
Commonwealth of Puerto Rico

APPENDIX B

Site Maps



LEGEND	
Symbol	Description
	MAP LOCATIONS
	MAJOR CONTOUR CONTOUR INTERVAL 25 METERS

CONTOUR SOURCE: 8' x 11' 1948 USGS QUADRANGLE.
VERTICAL DATUM: LOCAL MEAN SEAL LEVEL.
AERIAL SOURCE: (300I INC., 2005)
MAP PROJECTION: UNIVERSAL TRASVERSE MERIATOR.
ZONE: 19
DATUM: NAD 1927 (PUERTO RICO).

US Army Corps of Engineers
District or Division

Mark	Description	Date	Appr.
1	Delete B-2 Area & Relabel Areas	01/08	

Designed by: MGB	Date: 01/2006	Rev. 1
Dwn by: DSS / Ckd by:	Design file no.	
Reviewed by:	Drawing code:	
Submitted by: Chief, Arch. Branch	File name / Plot date / Plot scale: 1"=3000'	

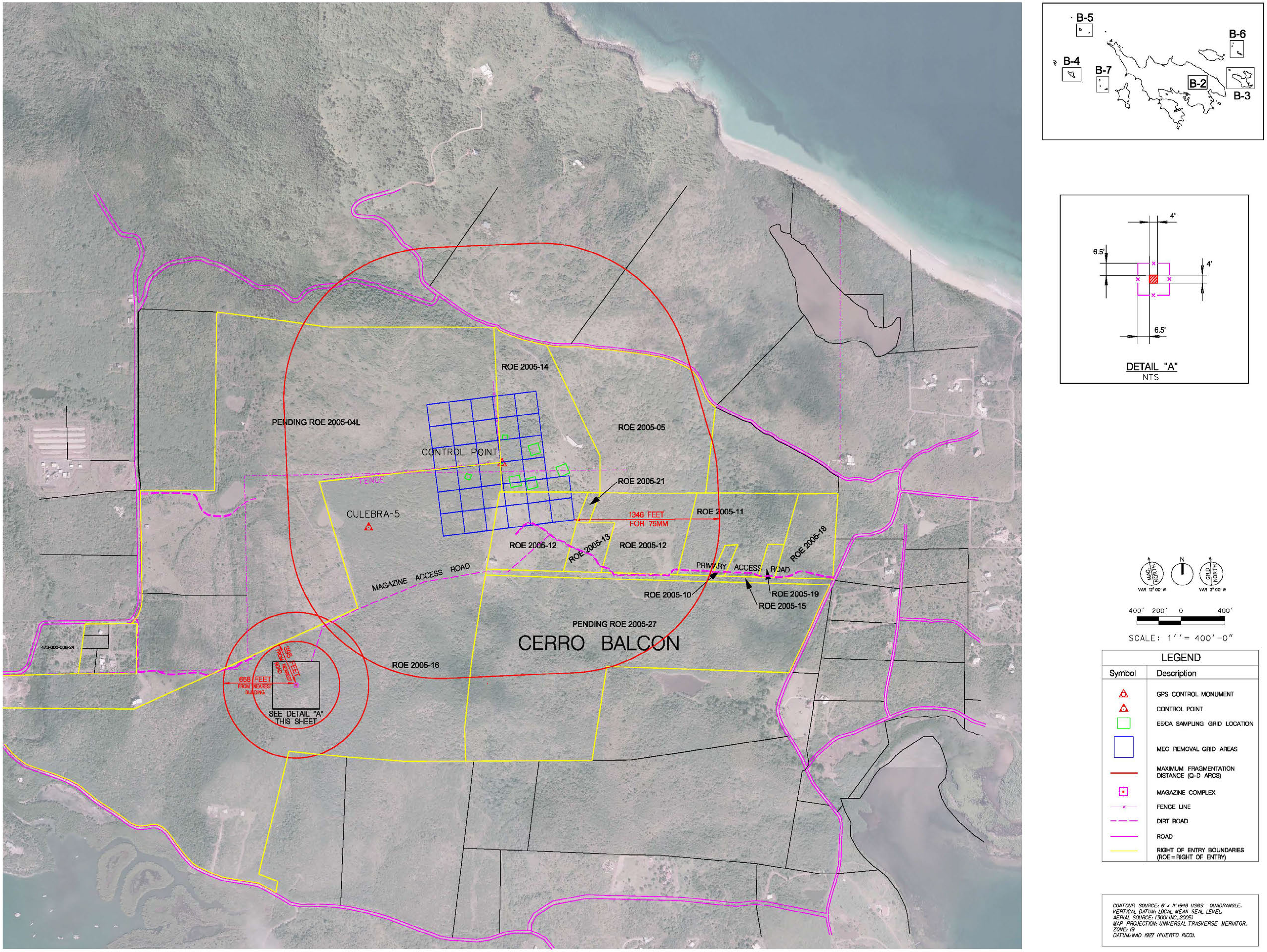
U.S. ARMY ENGINEERING AND SUPPORT CENTER
Huntsville, Alabama

ELLIS ENVIRONMENTAL GROUP
Newberry, Florida

NON-TIME CRITICAL REMOVAL ACTION
Culebra, Puerto Rico
Project No. 102PR006802 Contract No. W912DY-05-D-0007

CULEBRA MUNICIPALITY AND INVESTIGATION SITES

Sheet reference number:
B-1



LEGEND	
Symbol	Description
	GPS CONTROL MONUMENT
	CONTROL POINT
	EE/CA SAMPLING GRID LOCATION
	MEC REMOVAL GRID AREAS
	MAXIMUM FRAGMENTATION DISTANCE (Q-D ARCS)
	MAGAZINE COMPLEX
	FENCE LINE
	DIRT ROAD
	ROAD
	RIGHT OF ENTRY BOUNDARIES (ROE=RIGHT OF ENTRY)

CONTOUR SOURCE: 6' x 11' 1948 USGS QUADRANGLE.
VERTICAL DATUM: LOCAL MEAN SEAL LEVEL.
AERIAL SOURCE: (3001 INC.,2005)
MAP PROJECTION: UNIVERSAL TRASVERSE MERIATOR.
ZONE: 19
DATUM: NAD 1927 (PUERTO RICO).

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Mark	Description	Date	Appr.
1	Access Roads & ROE Numbers	01/06	

Designed by: MGB		Date: 01/2006	Rev. 1
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Reviewed by:		Drawing code:	
Submitted by: Chief, Arch. Branch		File name: 102PR006802SPB2.CWP Plot date: 6/2005 Plot scale: 1"=400'	

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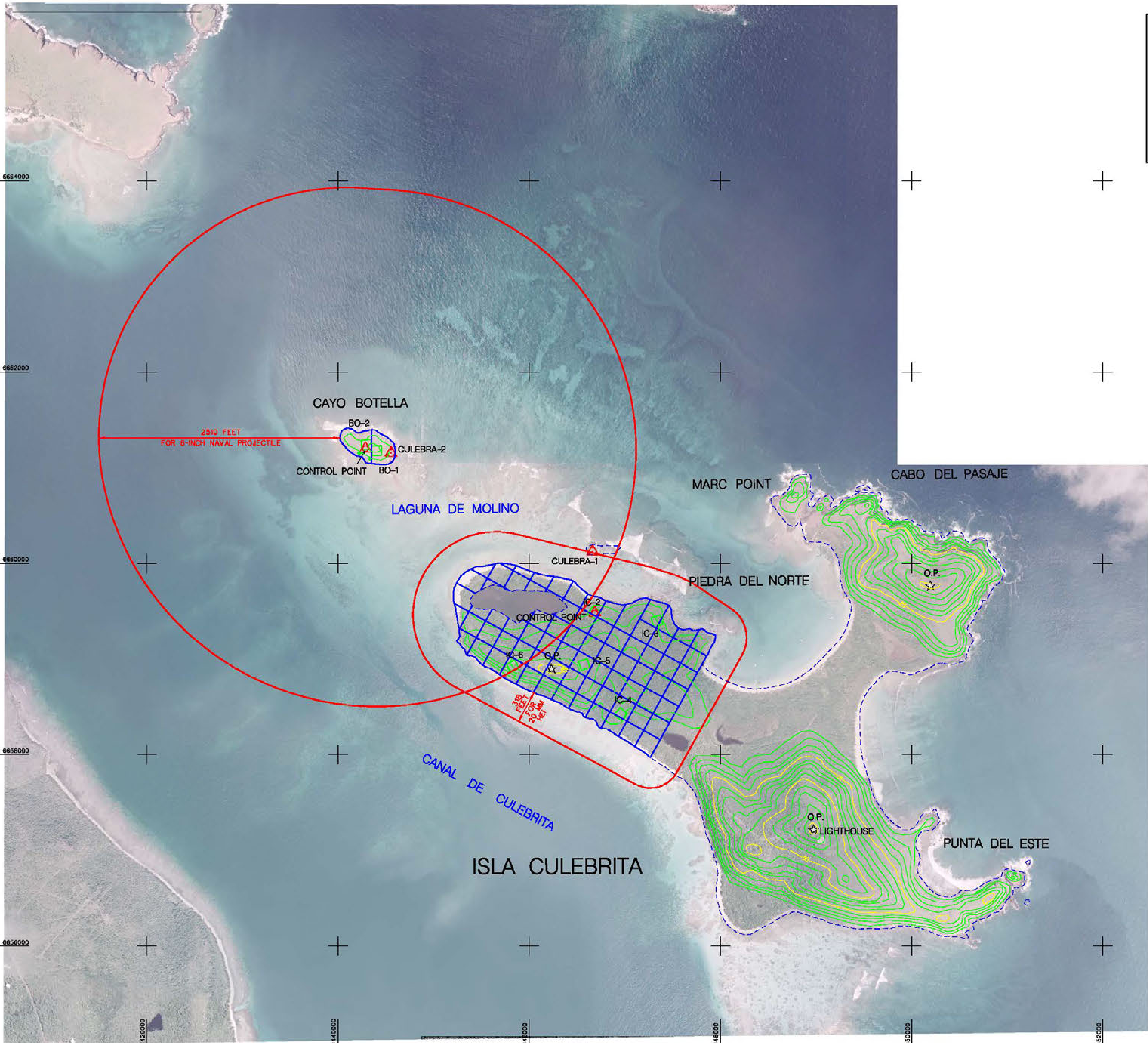
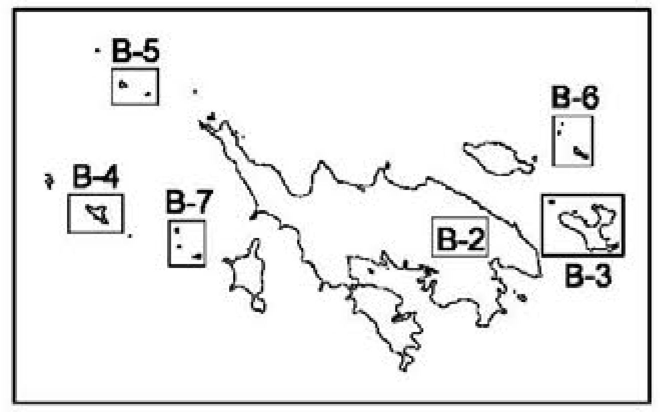
Newberry, Florida

NON-TIME CRITICAL REMOVAL ACTION
Culebra, Puerto Rico
Project No. 102PR006802
Contract No. W912DY-05-D-0007

CERRO BALCON (OOU-3)
GRID LAYOUT,
EXPLOSIVES MAGAZINE LOCATION
AND QUANTITY DISTANCE MAP

Sheet reference number:
B-2





SCALE: 1'' = 500'-0"

LEGEND	
Symbol	Description
	GPS CONTROL MONUMENT
	CONTROL POINT
	OBSERVATION POINT
	ESCA SAMPLING GRID LOCATION
	MEC REMOVAL GRID AREAS
	MAXIMUM FRAGMENTATION DISTANCE (Q-D ARCS)
	ISLAND DELINEATION
	MAJOR CONTOUR
	MINOR CONTOUR CONTOUR INTERVAL 5 METERS

CONTOUR SOURCE: 5' x 11' 1948 USGS QUADRANGLE.
VERTICAL DATUM: LOCAL MEAN SEAL LEVEL.
AERIAL SOURCE: (3001 INC., 2005)
MAP PROJECTION: UNIVERSAL TRAVERSE MERATOR.
ZONE: 19
DATUM: NAD 1927 (PUERTO RICO).

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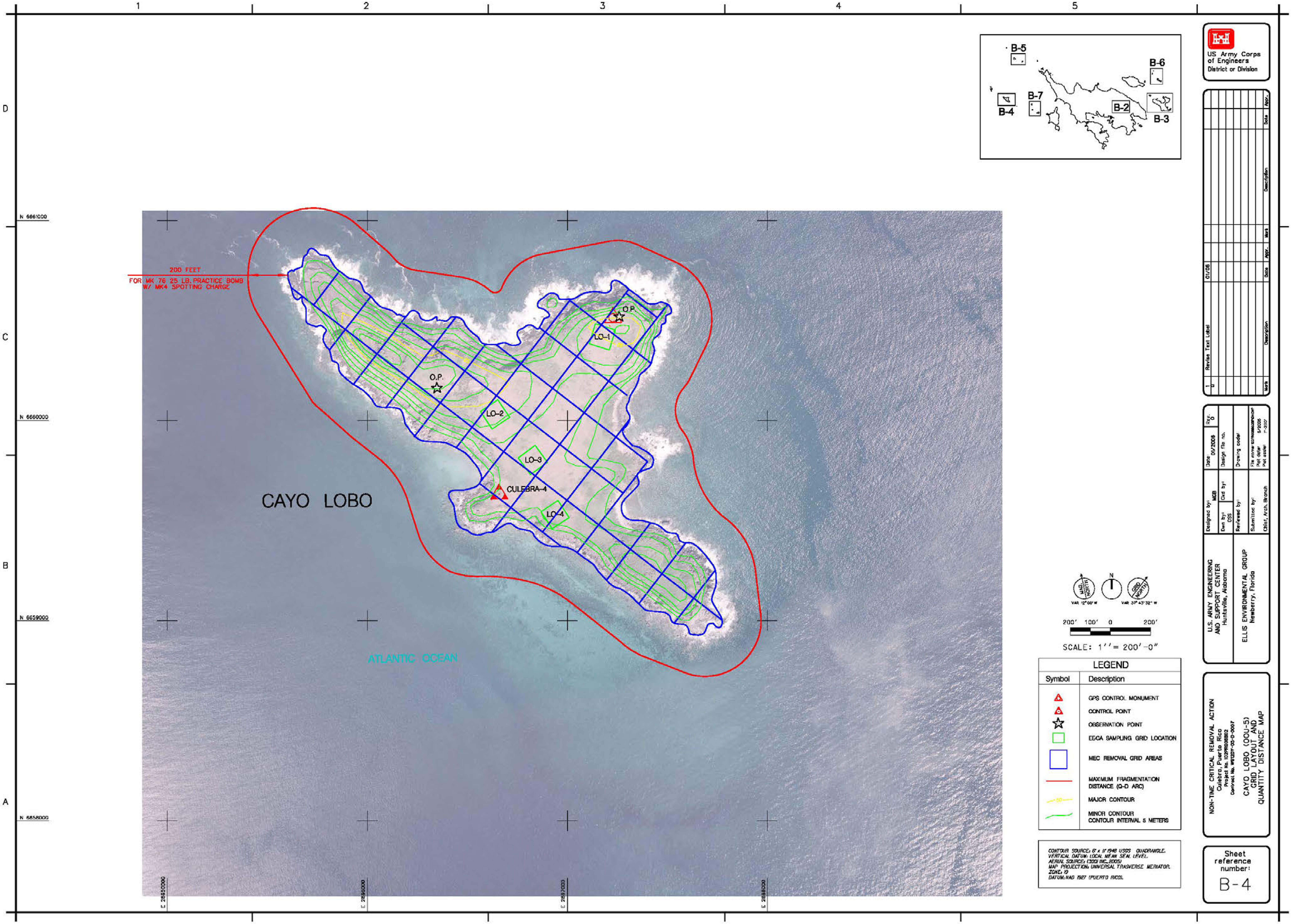
Ckd by:
Reviewed by:
Submitted by:
Chief, Arch. Branch
Date: 01/2008
Rev. 1
Design file no.
Drawing code:
Plot date: 5/2008
Plot scale: 1"-300'

NON-TIME CRITICAL REMOVAL ACTION
Culebra, Puerto Rico
Project No. I02PR006802 Contract No. W912DY-05-D-0007

CULEBRITA (OOU-4) AND CAYO BOTELLA (OOU-5) GRID LAYOUT AND QUANTITY DISTANCE MAP

Sheet reference number:
B-3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B-6
B-7
B-4
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N 6661000
N 6660000
N 6659000
N 6658000
200 FEET
FOR MK 76 25 LB. PRACTICE BOMB
W/ MK4 SPOTTING CHARGE
O.P.
LO-1
O.P.
LO-2
LO-3
CULEBRA-4
LO-4
CAYO LOBO
ATLANTIC OCEAN
E 2895000
E 2896000
E 2897000
E 2898000
N
200' 100' 0 200'
SCALE: 1''= 200'-0"
LEGEND
Symbol
Description
GPS CONTROL MONUMENT
CONTROL POINT
OBSERVATION POINT
EE/CA SAMPLING GRID LOCATION
MEC REMOVAL GRID AREAS
MAXIMUM FRAGMENTATION DISTANCE (Q-D ARC)
MAJOR CONTOUR
MINOR CONTOUR CONTOUR INTERVAL 5 METERS
CONTOUR SOURCE: 6' x 11' 1948 USGS QUADRANGLE.
VERTICAL DATUM: LOCAL MEAN SEA LEVEL.
AERIAL SOURCE: (3001 INC., 2005)
MAP PROJECTION: UNIVERSAL TRASVERSE MERIATOR.
ZONE: 19
DATUM: NAD 1927 (PUERTO RICO).
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District or Division
Revise Text Label
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Mark
Description
Date
Appr.
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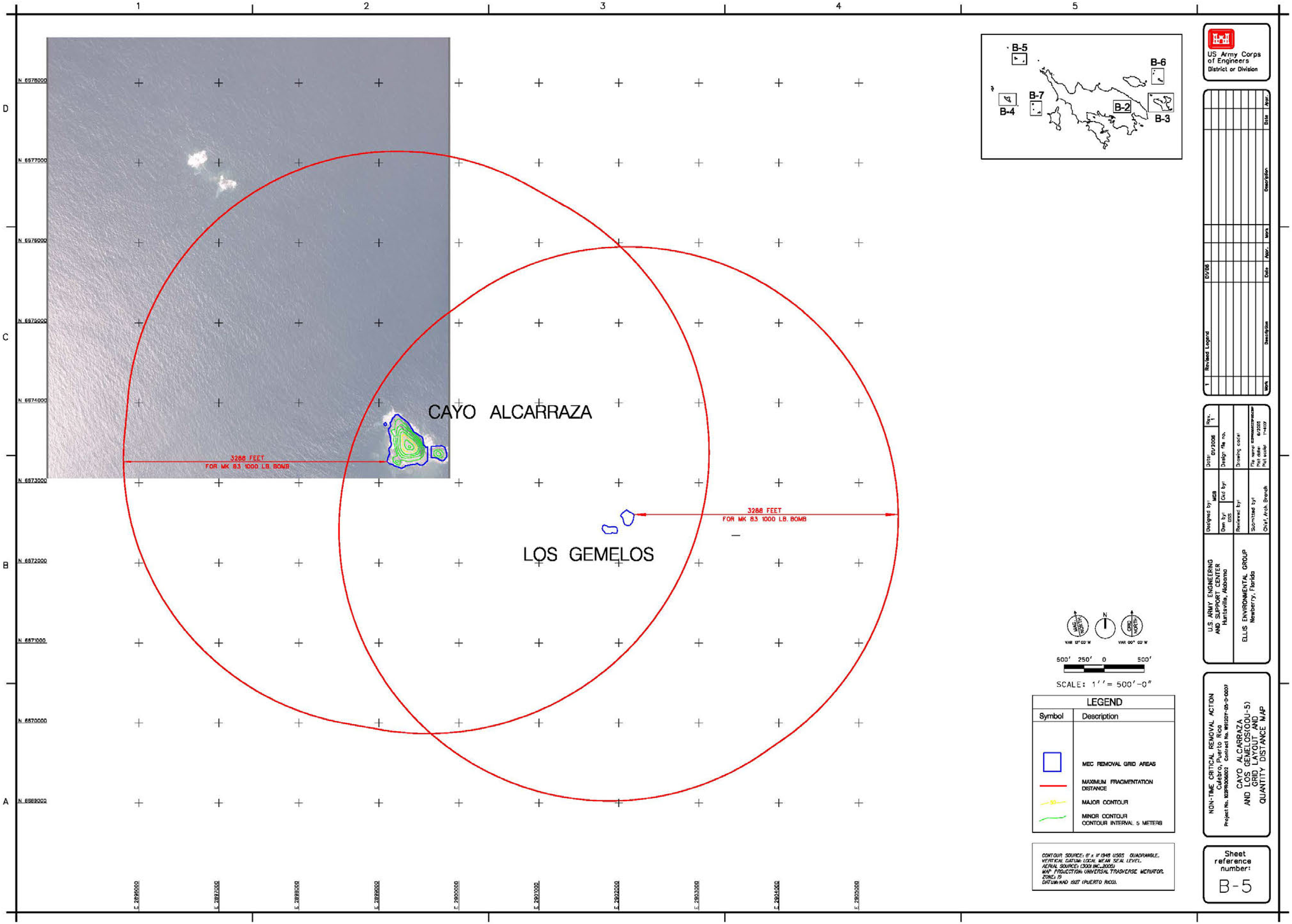
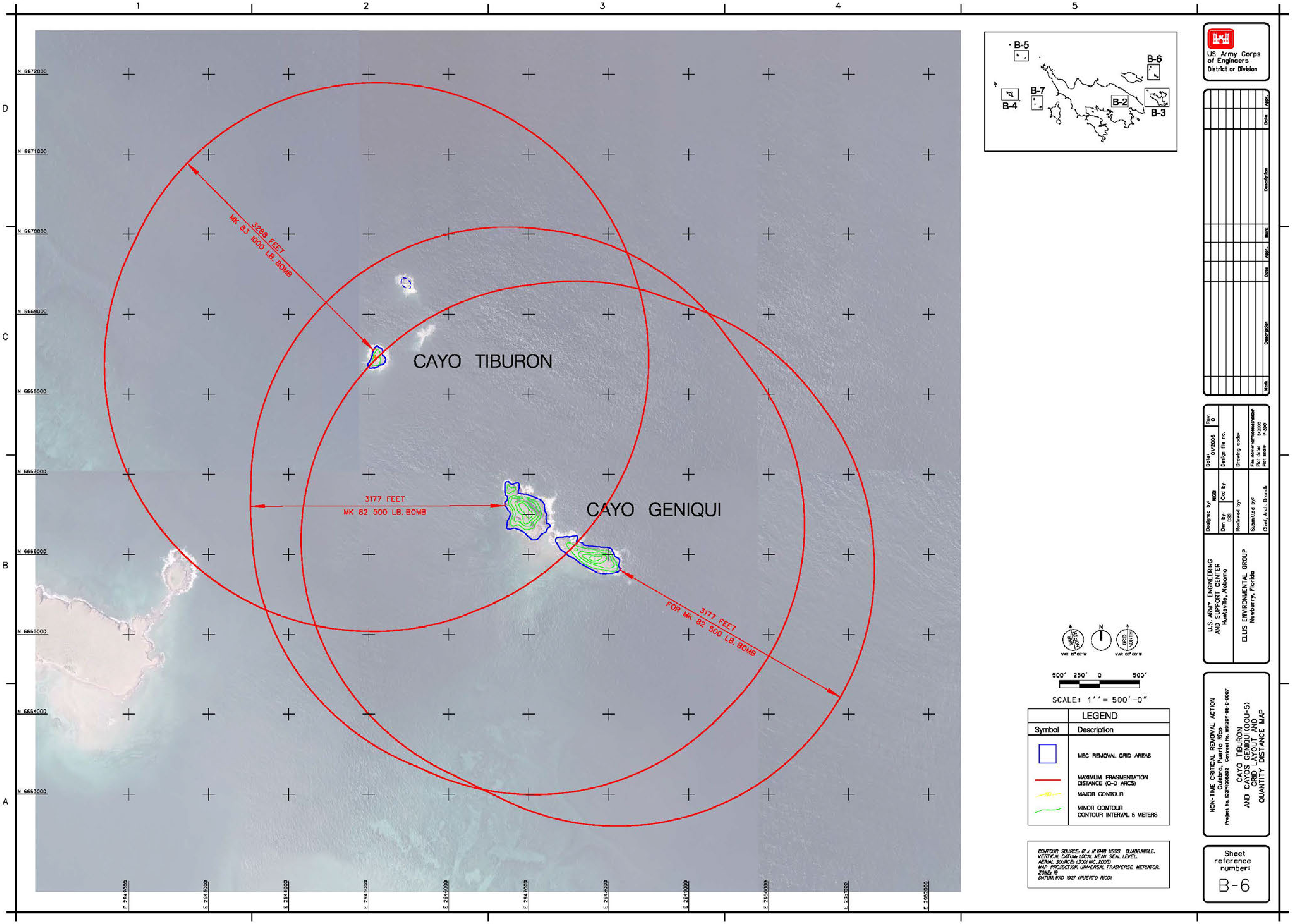
Huntsville, Alabama
ELLIS ENVIRONMENTAL GROUP
Newberry, Florida
Designed by: MGB
Dwn by: DSS
Ckd by:
Reviewed by:
Submitted by:
Chief, Arch. Branch
Date: 01/2008
Rev. 0
Design file no.
Drawing code:
Plot date: 5/2008
Plot scale: 1"=200'
NON-TIME CRITICAL REMOVAL ACTION
Culebra, Puerto Rico
Project No. I02PR008802
Contract No. W912DY-05-D-0007
CAYO LOBO (OOU-5)
GRID LAYOUT AND
QUANTITY DISTANCE MAP
Sheet reference number:
B-4



CAYO ALCARRAZA
LOS GEMELOS
3288 FEET
FOR MK 83 1000 LB. BOMB
3288 FEET
FOR MK 83 1000 LB. BOMB
B-5
B-6
B-7
B-4
B-2
B-3
US Army Corps of Engineers
District or Division
SCALE: 1'' = 500'-0"
LEGEND
Symbol
Description
MEC REMOVAL GRID AREAS
MAXIMUM FRAGMENTATION DISTANCE
MAJOR CONTOUR
MINOR CONTOUR
CONTOUR INTERVAL 5 METERS
U.S. ARMY ENGINEERING AND SUPPORT CENTER
Huntsville, Alabama
ELLIS ENVIRONMENTAL GROUP
Newberry, Florida
NON-TIME CRITICAL REMOVAL ACTION
Culebra, Puerto Rico
CAYO ALCARRAZA AND LOS GEMELOS(OOU-5) GRID LAYOUT AND QUANTITY DISTANCE MAP
Sheet reference number:
B-5



CAYO TIBURON
CAYO GENIQUI
3288 FEET
MK 83 1000 LB. BOMB
3177 FEET
MK 82 500 LB. BOMB
3177 FEET
FOR MK 82 500 LB. BOMB
B-5
B-6
B-7
B-4
B-2
B-3
SCALE: 1'' = 500'-0"
LEGEND
Symbol
Description
MEC REMOVAL GRID AREAS
MAXIMUM FRAGMENTATION DISTANCE (Q-D ARCS)
MAJOR CONTOUR
MINOR CONTOUR
CONTOUR INTERVAL 5 METERS
CONTOUR SOURCE: 6' x 11' 1948 USGS QUADRANGLE.
VERTICAL DATUM: LOCAL MEAN SEAL LEVEL.
AERIAL SOURCE: (3001 INC.,2005)
MAP PROJECTION: UNIVERSAL TRASVERSE MERATOR.
ZONE: 19
DATUM: NAD 1927 (PUERTO RICO).
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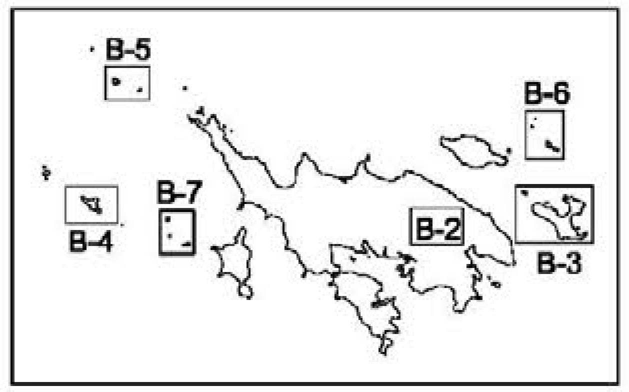
Huntsville, Alabama
ELLIS ENVIRONMENTAL GROUP
Newberry, Florida
NON-TIME CRITICAL REMOVAL ACTION
Culebra, Puerto Rico
CAYO TIBURON AND CAYOS GENIQUI (OOU-5) GRID LAYOUT AND QUANTITY DISTANCE MAP
Sheet reference number:
B-6



US Army Corps of Engineers
District or Division

VAR 12° 00' W
VAR 00° 00' W

200' 100' 0 200'

SCALE: 1'' = 200'-0"

LEGEND

Symbol	Description
	CONTROL POINT
	EE/CA SAMPLING GRID LOCATION
	MEC REMOVAL GRID AREAS
	MAXIMUM FRAGMENTATION DISTANCE (Q-D ARCS)
	MAJOR CONTOUR
	MINOR CONTOUR CONTOUR INTERVAL 5 METERS

CONTOUR SOURCE: 6' x 11' 1948 USGS QUADRANGLE.
VERTICAL DATUM: LOCAL MEAN SEAL LEVEL.
AERIAL SOURCE: (3001 INC., 2005)
MAP PROJECTION: UNIVERSAL TRASVERSE MERIATOR, ZONE: 19
DATUM: NAD 1927 (PUERTO RICO).

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Huntsville, Alabama

ELLIS ENVIRONMENTAL GROUP
Newberry, Florida

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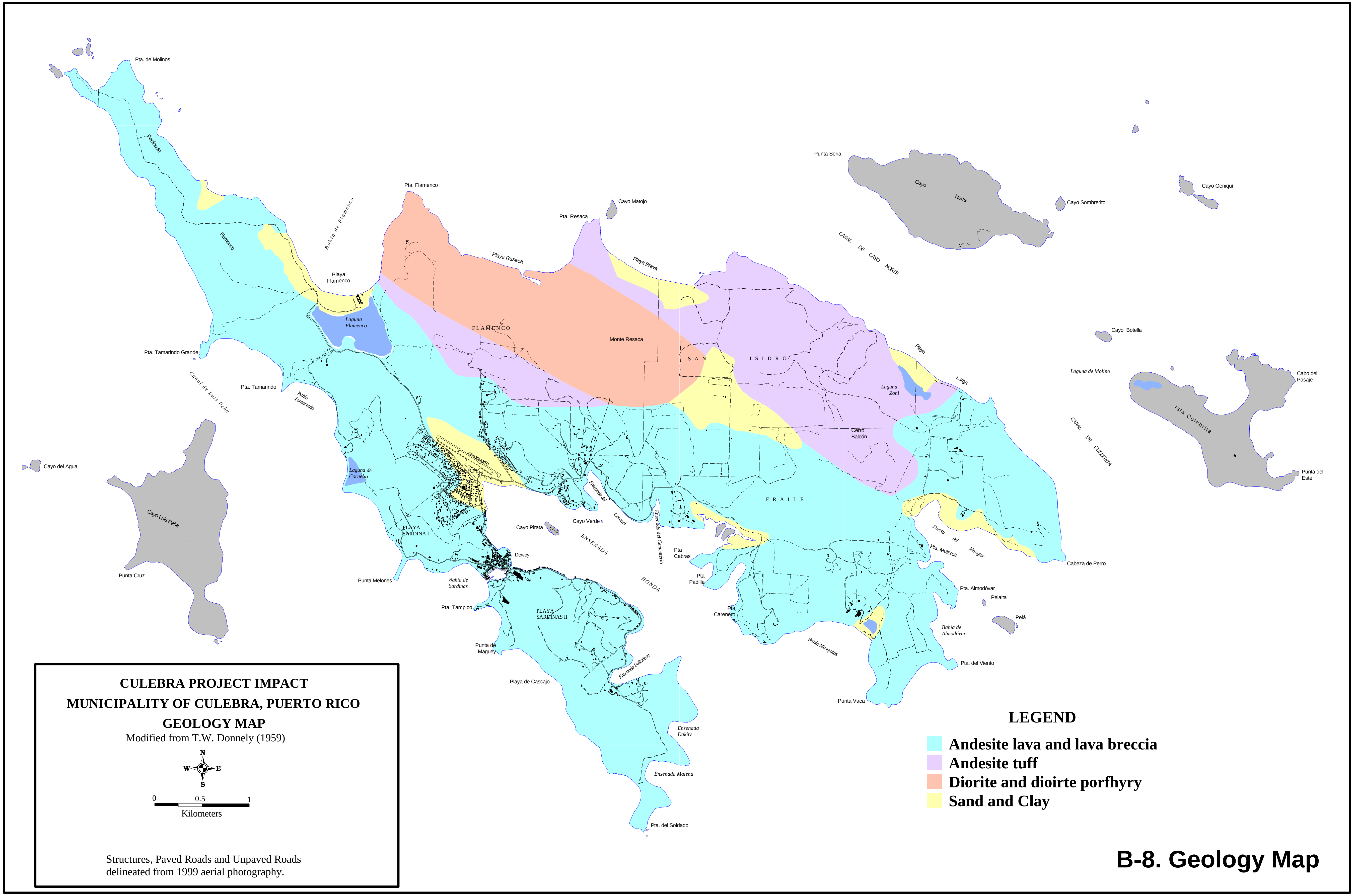
Dwn by: DSS
Ckd by:
Reviewed by:
Submitted by:
Chief, Arch. Branch
Date: 01/2006
Rev. 1
Design file no.
Drawing code:
Plot date: 6/2005
Plot scale: 1"=200'

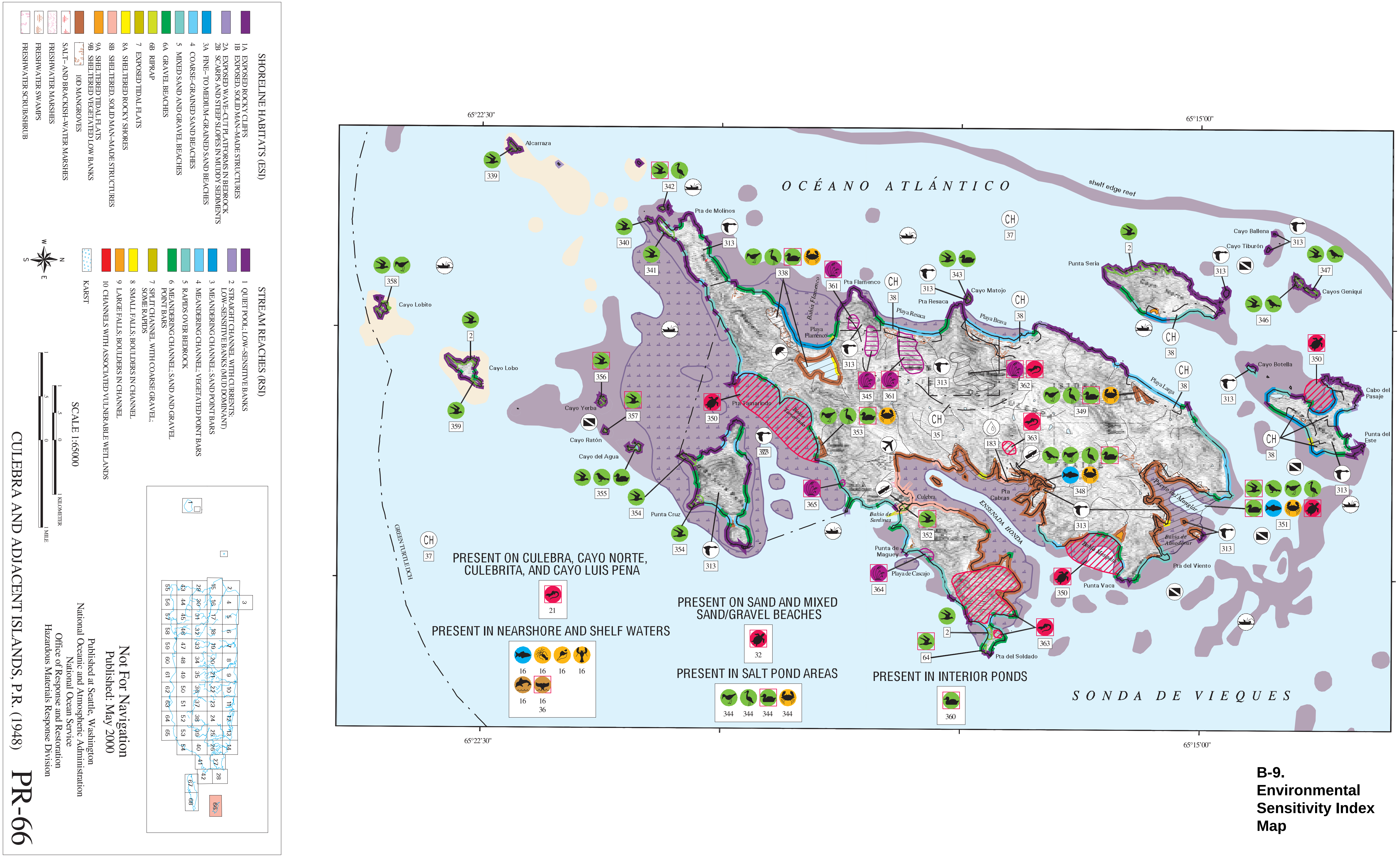
NON-TIME CRITICAL REMOVAL ACTION
Culebra, Puerto Rico
Contract No. W912DY-05-D-0007

CAYO DEL AGUA (OOU-5)
GRID LAYOUT AND
QUANTITY DISTANCE MAP

Sheet reference number:
B-7



B-8. Geology Map



B-9. Environmental Sensitivity Index Map

APPENDIX C

Local Points of Contact

Local Points of Contact

Contact	Agency	Telephone Number
	State Police	(787) 742-3501
	Culebra Police	(787) 742-0106
	Fire	(787) 742-3530
	Ambulance	(787) 742-3511
	Poison Control Center	(787) 962-1253
	Culebra Clinic	(787) 742-3511 (787) 742-0001
	PR Department of Natural Resources	787-742-3880
Brendan Slater	CEHNC PM	(256) 895-1507
Ricardo Vasquez	USACE Jacksonville	(904) 232-1649
Elsa Jimenez	USACE- Antilles	(787) 723-0133
Sgt. Amado Rivera	Police Bomb Squad, Humacao	(787) 852-1224
Theresa Tellevast	US Fish & Wildlife Service	(787) 742-0115
Yarissa Martinez	PR Environmental Quality Board	(787) 767-8056
	Municipality of Culebra	(787) 742-3521 (787) 742-2138
Mike Zaloudek	EEG SUXOS	Obtained Upon Mobilization
Mark Bagel	EEG PM	(352) 332-3888
Cellular Phones	Team 1	Obtained Upon Mobilization
Cellular Phones	Team 2	Obtained Upon Mobilization
Cellular Phones	Safety	Obtained Upon Mobilization
	EEG Culebra Office	Obtained Upon Mobilization
	EEG Culebra Fax	Obtained Upon Mobilization
Beepers	Gary Tourtellotte (EEG SM)	Obtained Upon Mobilization
	TBD (UXOQC/SO)	Obtained Upon Mobilization
	Mike Zaloudek (SUXOS)	Obtained Upon Mobilization
Diana Rivera	Federal Aviation Administration	(787) 253-8663
	Coast Guard Marine Safety Office Marine Safety Office Command Duty	(787) 289-0739 (787) 501-7678
Eric Hawk	NMFS Protected Resources Division	(727) 842-5312
Dr. Lisamarie Carrubba	NMFS Habitat Conservation Division	(787) 851-3700

FINAL WORK PLAN

Non-Time-Critical Removal Action at the Municipality of Culebra, Puerto Rico

APPENDIX D

Accident Prevention Plan

Prepared for

United States Army District, Jacksonville
United States Army Engineering and Support Center, Huntsville

Contract Number: W912DY-05-D-0007
Task Order Number: 0001
Project Number: I02PR006802

Prepared by

Ellis Environmental Group, LC
414 SW 140 Terrace, Newberry, FL 32669 • (352) 332-3888

January 2006

Contents

Tables

Figures

Attachments

Abbreviations & Acronyms

A-E	architecture-engineering
AFB	Air Force Base
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
AR	Army Regulation
CEHNC	United States Army Engineering and Support Center
CIH	certified industrial hygienist
CFR	Code of Federal Regulations
CPR	cardiovascular pulmonary resuscitation
db(A)	decibels (A-weighted)
DFARS	Defense Federal Acquisition Regulation Supplement
DoD	Department of Defense
DOT	Department of Transportation
EEG	Ellis Environmental Group, LC
EM	Engineer Manual
EMR	experience modification rate
EOD	explosive ordnance disposal
FWS	Fish and Wildlife Service
GPS	global positioning system
HAZWOPER	hazardous waste operations and emergency response
MEC	munitions and explosives of concern
mph	miles per hour
MPPEH	material potentially presenting an explosive hazard
NOAA	National Oceanic and Atmospheric Administration
OSHA	Occupational Health and Safety Administration
PFD	personal flotation device
PPE	personal protective equipment
QC	quality control
SUXOS	senior unexploded ordnance supervisor
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
UXO	unexploded ordnance
UXOQC/SO	unexploded ordnance quality control / safety officer

1.0 Signatuare Sheet

Plan Preparer

Gary Tourtellotte, Assistant Project Manager (352) 332-3888

for 1-25-06

Plan Approval

Jeffrey P. Bleke, Program Manager, Principal in Charge (352) 332-3888

1/25/06

Plan Concurrence

Terry Douglas, Certified Industrial Hygienist (865) 241-0449

Mark Bagel, Project Manager, Health and Safety Director (352) 332-3888

1-25-06

2.0 Background Information

2.1 Contractor

Ellis Environmental Group, LC (EEG)
414 SW 140th Terrace
Newberry, FL 32669
(352) 332-3888

2.2 Contract Number

W912DY-05-D-0007

2.3 Project Name

Non-Time-Critical Removal Action at the Municipality of Culebra, Puerto Rico

2.4 Project Description and Location

2.4.01 This project is to provide non-time-critical removal actions at the former naval target range on Culebra Island and its surrounding cays. All surface munitions and explosives of concern (MEC) over approximately 30 acres at the Cerro Balcon area on the Island of Culebra will be removed. All surface MEC over approximately 82 acres on the eastern end of Isla Culebrita will be removed. All surface MEC over approximately 39.5 acres from additional cays surrounding the Island of Culebra will be removed.

2.4.02 The project will be conducted at the Municipality of Culebra, Puerto Rico.

2.5 Contractor Accident Experience

2.5.01 EEG takes safety seriously in all aspects of its work. EEG is a highly regarded contractor that typically takes on the most difficult and hazardous tasks and has consistently performed work at a safe level above the safety norm. EEG's safety record is very good, with no accidents reported in the last year. EEG has had no Class A accidents involving a fatality, a permanent disability, or more than $1 million damage in equipment; no major safety violations; and only two minor safety violations over the past three years.

2.5.02 Due to EEG's safety record, the workers' compensation provider has issued the latest experience modification rate (EMR) at 0.85.

2.5.03 **Table 2-1** provides EEG's accident experience history. The data is from EEG's Occupational Safety and Health Administration (OSHA) Form 300A records beginning with first year that EEG was required to report accident and loss data in 1999 to the latest year filed.

Table 2-1. EEG Accident Experience

Accident Experience	2004	2003	2002	2001	2000	1999
EMR	0.9	0.9	0.94	1.0	1.0	0
Total Recordable Injury	3	9	8	10	18	14
Lost Workday Incidence Rate	0	0	1.3	1.3	0	0
Lost Time Incidence Rate	0	0	1.3	1.3	0	0
Total Number of Fatalities	0	0	0	0	0	0
Total Employee Hours Worked	189,690	222,323	198,296	146,109	33,099	28,380

2.6 Phases of Work and Hazardous Activities Requiring Activity Hazard Analyses

The phases of work and hazardous activities to be performed during the surface clearance of MEC on Culebra and surrounding cays are listed in the following table. Activity Hazard Analyses (AHAs) for the removal action are provided in Chapter 14 of this Accident Prevention Plan.

Table 2-2. Phases of Work for Non-Time-Critical Removal Action

Project Phase	Activity Description
Mobilization / Operation	Location survey and mapping
	Brush clearing
MEC Grids Preparation	Vegetation clearing using chain saw or bladed trimmer
	Heavy equipment operation
	Bush hog and tractor
Surface Clearance of MEC	Magnetometer survey
	Intrusive investigation of partially buried MEC
	Explosive disposal of MEC
	Scrap metal collection

3.0 Statement of Health and Safety Policy

3.0.01 EEG is committed to providing a safe and healthful work environment for its employees through the awareness and prevention of occupational injuries and illness. This plan is written in accordance with EM [Engineer Manual] 385-1-1 (3 Nov 03).

3.0.02 The objectives of EEG's health and safety policy are to reduce work-related accidents, injuries, and illness, and to promote safety and health awareness in all EEG projects. The policy objectives are to:

1. Have a safety committee for overseeing all aspects of safety and health activities for the company.
2. Conduct routine safety and health inspections to identify and eliminate unsafe working conditions or practices and to control occupational health hazards.
3. Determine the appropriate safety and health training requirements for all employees and subcontractor personnel.
4. Provide required personal protective equipment (PPE) and enforce its use.
5. Make provisions for thorough and prompt reporting and investigation of every accident to determine its cause, correct the problem, and reduce the likelihood of reoccurrence.
6. Provide a means for employees to voice safety concerns without fear of reprisal.
7. Require every site worker to comply with this policy as a condition of his or her employment and contract.

4.0 Responsibilities and Lines of Authority

4.1 Identification and Accountability of Personnel Responsible for Safety

4.1.1 Corporate Level

Mark Bagel is EEG's corporate health and safety director and the project manager. He has acted as corporate safety director for more than five years. He is responsible for assisting project managers to comply with the EEG Corporate Health and Safety Program, reviewing and monitoring compliance with project-specific health and safety plans, implementing corrective measures for health and safety deficiencies, and ensuring required training and medical monitoring of personnel. The corporate health and safety director has the authority to require corrective measures related to health and safety issues and to stop work, if required, to ensure a safe working environment.

4.1.2 Project Level

4.1.2.1 UXO Quality Control / Safety Officer

4.1.2.1.01 The UXO quality control (QC) / safety officer (UXOQC/SO) (to be determined) will be a United States citizen and graduate of one of the following schools or courses:

- United States Army Bomb Disposal School, Aberdeen Proving Ground, MD
- United States Naval EOD [explosive ordnance disposal] School
- EOD Assistants Course, Redstone Arsenal, AL; EOD Assistants Course, Eglin Air Force Base (AFB), FL; or a Department of Defense (DoD)-certified equivalent course

4.1.2.1.02 This individual shall have experience in MEC operations and supervising personnel, and shall have at least 10 years of UXO experience. In addition, this individual shall have the specific training, knowledge, and experience necessary to implement the Accident Prevention Plan and verify compliance with applicable safety and health requirements. This individual must be able to perform all functions enumerated for UXO sweep personnel and UXO Technicians I, II, and III. In addition, the UXOQC/SO must have the ability to implement the approved MEC and explosives safety program in compliance with all DoD, federal, state, and local statutes and codes; analyze MEC and explosives operational risks, hazards, and safety requirements; establish and ensure compliance with all site-specific safety requirements for MEC and explosives operations; enforce personnel limits and safety exclusion zones for MEC removal operations and MEC transportation, storage, and destruction; and conduct safety inspections to ensure compliance with MEC and explosives safety codes.

4.1.2.1.03 The UXOQC/SO is responsible for performing the routine duties for health and safety and QC functions, with the assistance of the health and safety director, and will administer the Site-Specific Health and Safety Plan (Attachment B). Responsibilities include:

- Performing regular and frequent site inspections to find hazards and to observe personnel at work
- Stopping work when necessary to prevent injury or illness
- Ensuring personnel and environmental health and safety
- Investigating all injuries and illnesses
- Developing and implementing corrective action plans to eliminate or mitigate hazards

4.1.2.2 Senior UXO Supervisor

4.1.2.2.01 The senior UXO supervisor (SUXOS) will be Michael Zaloudek, who has the following training and certifications:

- Basic EOD School, Indian Head
- Nuclear Weapons Orientation Advanced Course, Kirtland AFB, NM
- United StatesArmy Chemical/Biological School; Redstone, AL
- Explosive/Nuclear/Missile Safety School, Lowery AFB, CO
- United States Air Force Munitions Officer Course, Lowery AFB, CO
- OSHA 40-Hour Hazardous Waste Site Workers Course
- OSHA 8-Hour Supervisory Training Course

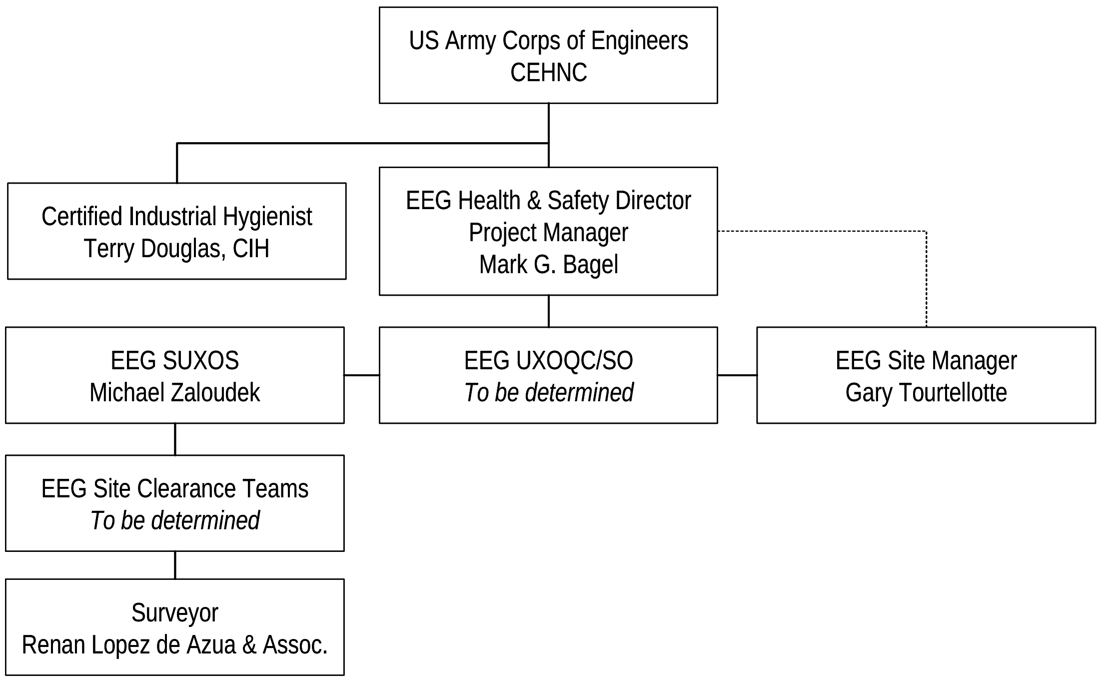
4.1.2.2.02 Duties and responsibilities will include:

- Conducting and supervising equipment maintenance and function checks
- Supervising surface clearance investigations
- Job safety during all MEC operations
- Ensuring that all personnel are properly trained
- Ensuring that all MEC operations field logs are updated daily
- Ensuring safe, compliant transportation of explosives on site
- Ensuring that explosives management activities are conducted in accordance with the Work Plan
- Ensuring that site preparation activities are completed in accordance with the Work Plan
- Ensuring that MEC operations are conducted in strict conformance with the Work Plan

4.2 Lines of Authority

The organization chart in **Figure 4-1** presents the lines of authority that will be in place to ensure that this Accident Prevention Plan is followed throughout the completion of the project.

Figure 4-1. Project Health and Safety Organization



5.0 Subcontractors and Suppliers

5.1 Identification of Subcontractors and Suppliers

EEG will self-perform all work for this contract except the surveying. **Table 5-1** presents known subcontractors and suppliers.

Table 5-1. Subcontractors and Suppliers

Subcontractors and Suppliers	Items or Tasks Provided
Renan Lopez de Azua & Associates	Surveyors
Severn Trent Laboratories (STL) Chicago	Analytical laboratory
Halliburton Explosives	Jet perforators and detonating cord
Slurry Corporation	Binary explosives and blasting caps
Atlantic Explosives	Other Explosives

5.2 Means for Control and Coordination of Subcontractors and Suppliers

5.2.01 EEG will schedule and coordinate work activities of the subcontractors and suppliers on the project with the goal to complete the project on time and within budgetary constraints.

5.2.02 EEG holds the sole responsibility for the scheduling and delivery of materials from suppliers. To meet the schedule, EEG will order the materials with the longest lead time first. Priorities for ordering will be set on the estimated time for deliveries.

5.2.1 Safety Responsibilities of Subcontractors and Suppliers

All subcontractors shall adhere to this Accident Prevention Plan and shall assume the responsibilities described herein.

6.0 Training

In accordance with 29 Code of Federal Regulations (CFR) 1910.120 and other OSHA regulations, all personnel assigned to perform removal operations will have the required hazardous waste operations and emergency response (HAZWOPER) training prior to participating in site activities. Surveyors, brush cutting personnel, and other incidental personnel will be required to have site-specific training covering the hazards at the site and the basic contents of this Accident Prevention Plan. Documentation of all training is required to be kept on site.

6.1 Subjects of Safety Indoctrination

Safety indoctrination of employees shall include a discussion of the following subjects:

- Identification of project, scope of work, and project location
- Identification of potential hazards and assessment of hazards
- Identification of training and medical requirements
- Identification of personnel protection requirements and safe working procedures
- Identification of documents and forms that comprise the complete safety program
- Identification of monitoring and site control programs
- Identification of spill control procedures
- Identification of emergency response and notification plan

6.2 Mandatory Training and Certifications Applicable to Project

Table 6-1 lists the applicable mandatory safety training and certifications for employees on this project.

Table 6-1. Training and Certifications

Personnel	Training	Requirements
MEC removal employees (UXO technicians)	HAZWOPER, including blood borne pathogens and hazard communication	40-hour and 8-hour refreshers
	First aid / Cardiovascular pulmonary resuscitation (CPR)	At least 2 on site at all times
	Graduate of EOD / Bomb Disposal School / EOD Assistants Course	UXO personnel certification
	Site-specific safety indoctrination	Prior to site entry
Surveyors, equipment operators, and brush cutting personnel	Site-specific safety indoctrination	Prior to site entry

Personnel	Training	Requirements
Project and site manager	HAZWOPER, including blood borne pathogens and hazard communication	40-hour and 8-hour refreshers
	First aid / CPR	At least 2 on site at all times
	Site-specific safety indoctrination	Prior to site entry
Site visitors and site administrator	Site-specific safety indoctrination	Prior to site entry

6.3 Requirements for Emergency Response Training

All UXO technicians, the site manager, and the project manager will have completed the 40-hour HAZWOPER course. At least two team members will be trained by the Red Cross or equivalent in first aid and CPR. On-site EEG personnel will receive training in controlling exposures to blood-transmitted pathogens.

6.4 Requirements for Supervisory and Employee Safety Meetings

6.4.1 Tailgate Safety Briefing

The purpose of this training is to identify potential hazards and risks that may be encountered during that day's activities. All contractor and subcontractor employees and any government personnel present will attend this training. This training will be given each day, before work starts on site, and will be conducted by the UXOQC/SO. It will be documented on the Tailgate Safety Briefing / Training Form (included in Appendix F of the Work Plan), which will include the date, attendees, and topics covered.

6.4.2 Additional Training

Training will be provided in the use of safety equipment, emergency medical procedures, emergency assistance notification procedures, and accident prevention. In addition, planned activities will be discussed to ensure that the work can be carried out safely and effectively. All contractor and subcontractor employees and any government personnel present will attend this training, which will be conducted by the UXOQC/SO or his designee during the tailgate safety briefing. This training will also be documented on the Tailgate Safety Briefing / Training Form.

6.4.3 Debriefing

During the tailgate safety briefing, the UXOQC/SO will debrief the team concerning items observed during his inspections, corrective actions, and good safety practices observed.

7.0 Safety and Health Inspections

7.1 Inspection Procedures

7.1.01 The UXOQC/SO will perform regular safety inspections of the project and will complete the Safety Inspection Checklist (included in Appendix F of the Work Plan) during the inspection. The checklist will be submitted to the project manager. A one-week period will be allowed for improvements to be made. The UXOQC/SO will perform a follow-up inspection to ensure that all applicable improvements have been made to the project site.

7.1.02 The EEG project manager may conduct safety inspections during the period of performance. An inspection report will be filed to document compliance and non-compliance issues observed.

7.2 External Inspections and Certifications

Currently no requirements exist for any external inspections or certifications.

8.0 Safety and Health Expectations, Incentive Programs, and Compliance

8.0.01 EEG corporate policy includes safety in all aspects of its operation. This plan has been developed to convey the safety message to EEG employees. It is EEG's responsibility to:

- Respond to employee reports of hazards in the workplace
- Ensure that each workplace is inspected routinely for hazardous conditions (EEG will post notices of unsafe or unhealthful working conditions found during the inspections for a minimum of three working days, or until the hazard is corrected, whichever is later)
- Take prompt action to ensure that hazardous conditions are eliminated (imminently dangerous conditions will be corrected immediately)
- Acquire, maintain, and require use of appropriate protective and safety equipment
- Require supervisors to submit an Accident / Injury Investigation form for all work-related accidents, injuries, or occupational illnesses experienced by employees under their supervision

8.0.02 Every EEG employee is responsible for:

- Complying with all OSHA and approved occupational safety and health standards, policies, and directives
- Performing all work in accordance with EM 385-1-1 (3 Nov 03)
- Using appropriate provided protective and safety equipment

8.0.03 EEG does not offer a safety incentive program.

8.0.04 Compliance with all applicable safety regulations and procedures is mandatory.

9.0 Accident Reporting

The UXOQC/SO will be responsible for all accident reporting and documentation, including:

- Maintaining and submitting exposure data
- If a reportable injury, illness, or accident occurs at the job site, ensuring that the appropriate documentation will be completed and forwarded to EEG within 48 hours
- Ensuring that the accident is discussed in the following tailgate safety briefing
- Immediately notifying all appropriate designated government personnel of major accidents
- Completing appropriate Accident / Injury Investigation forms

9.1 Logs, Reports, and Recordkeeping

All recordkeeping will be in accordance with applicable OSHA standards and regulations. Appendix F of the Work Plan contains sample safety logs and forms. The following logs and records (at a minimum) will be completed and retained by the UXOQC/SO.

9.1.1 Safety Log

The UXOQC/SO will maintain a safety log of all safety-related activities and will be responsible for ensuring that safety and health activities for the day, as well as tailgate safety briefing minutes, are part of the log. When safety and health deficiencies are noted during daily inspections, the measures, timetable, and individual responsible for correcting the deficiencies will be noted in the safety log.

9.1.2 Tailgate Safety Briefing / Training Form

The UXOQC/SO is responsible for ensuring that all training conducted relative to job site activities is documented appropriately on the Tailgate Safety Briefing / Training Form.

9.1.3 Visitor Log

A Visitor Log will be maintained at the entrance to each work site to record visitors to the job site.

9.1.4 Reports

The following reports will be submitted as required by applicable USACE and OSHA regulations.

- Medical monitoring records of employee(s) will be kept on site by the UXOQC/SO.

- If a reportable injury, illness, accident occurs at the job site, the appropriate form will be completed and forwarded within 24 hours to EEG. The Accident / Injury Investigation form will be completed for all accidents and illnesses that are work-related. If a serious accident occurs that results in lost days and/or damage in excess of $2,000, EEG will submit to the United States Army Engineering and Support Center (CEHNC) project manager ENG Form 3394, United States Army Corps of Engineers (USACE) Accident Investigation Report, in accordance with AR [Army Regulation] 385-40. A copy of this form is included in Appendix F of the Work Plan.

10.0 Medical Support

10.1 Rescue and Medical Duties

10.1.01 Team members are to be alert to the dangers associated with the site at all times. If an unanticipated hazardous condition arises, they will stop work, evacuate the immediate area, and notify the UXOQC/SO. Emergency situations should be handled in a calm and orderly fashion. The UXOQC/SO will be responsible for ensuring quick and effective response to all hazardous situations and accidents.

10.1.02 In case of a medical emergency that threatens life, limb, or sight, the UXOQC/SO or his designee will immediately contact the Culebra Community Medical Center (telephone 787-742-3511) for medical assistance. If serious trauma or a life-threatening accident or illness has occurred, the Community Medical Center will be notified to send for airlift support from Life Fllight or local aircraft support to the main island.

10.1.03 The route map to the Community Medical Center will be posted on the project safety bulletin board on site. Additionally, all site personnel will drive to the medical center to learn the location. The route map is included in the Site-Specific Health and Safety Plan (Attachment A).

10.2 On-Site Personnel Trained in First Aid and CPR

- Site manager – Gary Tourtellotte
- SUXOS – Michael Zaloudek
- UXOQC/SO – to be determined
- UXO team personnel – to be determined

10.3 Off-Site Medical Treatment Facility

10.3.01 The primary off-site treatment for non-life threatening illnesses or injuries that occur on the job site will be provided at the Culebra Community Medical Center (telephone 787-742-3511) located at Calle William Font Final. For more serious conditions, transport to Fajardo or San Juan, Puerto Rico, may be necessary and will be coordinated through the Culebra Community Medical Center.

10.3.02 Acute care services are provided by the San Pablo del Este Hospital (telephone 787-863-0505), located at General Valero Ave. #404 in Fajardo, Puerto Rico. The hospital provides medical, ambulatory and emergency services to the community of Fajardo and nearby communities Luquillo, Ceiba, Río Grande, Culebra, and Vieques.

11.0 Personal Protective Equipment

AHAs will be conducted by the UXOQC/SO or the health and safety director to determine what PPE is required for a given task. This section discusses the hazard classes that are considered when determining PPE requirements. PPE requirements are provided in the AHAs for this project, presented in Chapter 14.

11.1 Impact

The impact hazard classification shall be used to assess the various risks associated with machinery, equipment, tool use, objects, and an employee's position in relationship to the work being performed. Contusions, crushing, pinching, vibration, and repeated shock are some of the harmful results that can be attributed to impact. Examples of impact hazards can include falling tools, materials, and packaging; hammers; presses; and heavy machinery and equipment operation.

11.2 Penetration

The penetration hazard classification shall be used to assess the various risks associated with machinery, equipment, hand tools, laboratory implements, materials, and objects. Cuts, punctures, and lacerations can result from objects penetrating clothing, PPE, and footwear. Examples of penetrating hazards include razors, punches, power-actuated tools, and sharp metal surfaces or edges.

11.3 Compression

The compression hazard classification shall be used to assess the risks associated with machinery, equipment, packaging, material handling, vehicles, and any other devices which when moving could pose a physical threat to workers. Examples of compression hazards include work involving rolling stock, presses, lifts, powered cylinders and pistons (hydraulic, pneumatic, etc.), heavy goods and materials, and warehousing.

11.4 Chemical

The chemical hazard classification includes a wide variety of materials and conditions, which can be both physical and health hazards. To complicate the assessment, it should be recognized that not all individuals are similar with respect to how they may be adversely affected by a chemical, including concentrations that may be published as safe result in a worker experiencing symptoms. Risks associated with chemicals include contact, absorption, inhalation, ingestion, and injection.

Examples of chemical hazards include but are not limited to corrosives, solvents, oils, fuels, drugs, and biological agents.

11.5 Heat

The heat hazard classification shall be used to assess the risks associated with process machinery, equipment, electrical and liquid processes, and any other heat-generating mechanisms or devices. Examples of heat hazards include work involving the use of flame, hot liquids, packaging operations, and ovens.

11.6 Harmful Dusts

The harmful dust hazard classification shall be used to assess various risks associated with operations where the generation of dust may produce a respiratory or contact hazard. The primary focus should be the source (type) and degree of its generation. Some examples of operations where harmful dusts can be generated include polishing, sawing, sanding, cleaning, and grinding. Dust generation will be minimized by wet cutting where applicable.

11.7 Radiation

The radiation hazard classification includes light, infrared, ionizing, and non-ionizing sources. Risk associated with many types of machinery and equipment involve radiation exposure. It is incumbent upon managers/supervisors to adequately assess this form of hazard and protect workers through the use of appropriate engineering controls, work practices, PPE, or a combination of each. Some examples of radiation hazards include visual display terminals, lasers, microwave, open flames, power transmission, and manufacturing of products with radiation sources (medical, mining, nuclear fuel etc.).

11.8 Electrical

The electrical hazard classification shall be used to assess the various risks associated with operations where exposure to electrical energy may pose a hazard. While a number of work activities are covered under Lockout / Tagout (Control of Hazardous Energy), many other types of work tasks and operations expose workers to risk due to the presence of electrical energy. Some examples of operations where electrical hazards should be assessed include most machinery, equipment, and tool use.

11.9 Motion

The motion hazard classification shall be used to assess the risks associated with repeated motions made by a worker operating a tool or machine, which can lead to a number of injuries collectively called cumulative trauma injuries. Cumulative trauma injuries are difficult to characterize because the appearance of symptoms vary from person to person. Factors such as frequency of activity, forces applied, and duration of force and activity require analysis. Some examples of operations where motion hazards exist are typing, use of spray guns, power tools, and machine handles, and use of tools such as hammers and ratchets.

11.10 Noise

11.10.01 PPE equivalent to the combination of earplugs and earmuffs shall be required for sound-pressure levels exceeding 115 dB(A) [decibels A-weighted] steady state. Noise hazard areas shall be marked with caution signs indicating both the presence of hazardous noise levels and the requirement for hearing protection.

11.10.02 Protection against the effects of hazardous noise exposure will be provided whenever sound-pressure levels exceed the limits and/or exposure times (see Attachment A, Site-Specific Health and Safety Plan).

11.11 Water

United States Coast Guard (USCG)-certified life jackets or work flotation vests will be worn by all employees working on or near the water at all times during project activities. The UXOQC/SO shall ensure compliance with this requirement.

12.0 Plans Required by EM 385-1-1 (Safety Manual)

This chapter presents the plans (programs, procedures) required by EM 385-1-1 (Safety Manual) that apply to the activities required for surface clearance of MEC (applicable EM 385-1-1 section numbers are shown in parentheses).

12.1 Layout Plans (04.A.01)

12.1.01 The site layouts are provided in Appendix B of the Work Plan. Subchapter 12.6 provides a discussion of access and haul roads.

12.1.02 The support zone will be used as the staging area for site operations and for other support functions required to maintain smooth operations on site. The support zone includes the change area, the lunch and break areas, and the supply storage areas. The support zone is designated as the tobacco product use and the eating and drinking area.

12.1.03 The work zone will be the area where actual site activities are conducted. Non-qualified personnel entering the work zone will be escorted by qualified personnel at all times. Site security will be maintained during working hours by the UXOQC/SO, who will ensure that the only personnel entering a given work zone are those who are wearing the proper PPE and have been trained and medically cleared to enter the area. The UXOQC/SO will also ensure that all other health and safety precautions are in place prior to entry by site personnel.

12.2 Emergency Response Plans

12.2.01 Emergency situations can be minimized through the proper implementation of the procedures in this subchapter. If an emergency situation develops, the UXOQC/SO will act as the on-scene incident commander. Emergency situations will be handled in a calm and deliberate manner so that the situation is controlled and the safety and health of the site workers and surrounding communities are not jeopardized.

12.2.02 The emergency shall be reported to the UXOQC/SO. The UXOQC/SO will call for assistance and describe the situation to emergency response personnel. After executing the necessary phone calls for emergency response, the UXOQC/SO will notify the contracting officer's representative and the EEG project manager.

12.2.1 Procedures and Tests (01.E.01)

12.2.1.1 Emergency Response Plan Procedures

12.2.1.1.01 Evacuation routes, assembly points, site control points, and the hospital route map and emergency telephone numbers (see Subchapter 12.2.4) will be posted at the site. Hospital route maps shall also be maintained in the designated emergency location as well as in all site vehicles and work areas. All personnel will be aware of the location of the closest telephone access. Each UXO team will have communication access to the UXOQC/SO. The list of the emergency telephone numbers shall be readily available to all employees on the job site, and all numbers shall be able to be reached via cellular phone.

12.2.1.1.02 An air horn will be carried by each work team and one kept at the support zone. One long blast on the air horn will be the signal to evacuate the site immediately. Personnel in the exclusion zone will evacuate to the assembly point specified during the tailgate safety briefing. Once all personnel are accounted for, the UXOQC/SO will outline the actions to be taken as determined by the situation. Two short blasts on the air horn is the all clear signal.

12.2.1.1.03 No one will attempt emergency response or rescue until the situation has been assessed and the appropriate response outlined by the UXOQC/SO. **Table 12-1** lists activities that may be included in response or rescue. Some activities may be conducted concurrently.

Table 12-1. Potential Rescue Response Activities

Activity	Description
Buddy system	Allow no one to enter a contaminated area or hazardous area without a partner. Personnel in the exclusion zone should be in line of sight or communications contact with the supervisor or designated appointee at all times.
Casualty assessment	Survey casualties.
	Locate all victims and assess their condition.
	Determine resources needed for stabilization and transport.
Hazard assessment	Assess existing and potential hazards to site personnel and the off-site population.
	Determine whether and how to respond.
	Evaluate the need for evacuation of site personnel and off-site population.
	Evaluate the resources needed for evacuation and response.
Request aid	Contact the required off- or on-site personnel or facilities, such as the ambulance, fire department, police, etc. (see Table 12-3).
Allocate resources	Allocate on-site personnel and equipment to rescue and initiate incident response operations.
Control	Assist in bringing the hazardous situation under complete or temporary control and use measures to prevent the spread of the emergency (e.g., cover hole with tarp or plastic or wood, control fire, and secure site).

Activity	Description
Extricate	Remove or assist victims from the area.
Stabilize	Administer any medical procedures that are necessary before the victims can be moved. Stabilize or permanently fix the hazardous condition. Attend to what caused the emergency and anything damaged or endangered by the emergency (e.g., drums and tanks).
Transport	No one will be transported without any required decontamination. Take measures to minimize chemical contamination of the transport vehicle, ambulance, and hospital personnel.
Casualty logging	Record victim's name, time, destination, and victim's condition at transport.
Casualty tracking	Record disposition, condition, and location.

12.2.1.2 Emergency Equipment

12.2.1.2.01 Emergency equipment will be maintained in proper working order and checked daily for completeness during the site work. **Table 12-2** lists the type and location of emergency equipment that will be on site.

Table 12-2. On-Site Emergency Equipment

Equipment	Quantity	Location	Operation
First aid / burn kit	3	Support vehicles / support zone	All
Portable eye wash	3	Support vehicles / support zone	All
CPR pocket mask	1	Support vehicles / support zone	All
Air horn	3	Support zone / work zone	All
Fire extinguisher	2	Support vehicles / work zone	All

12.2.1.2.02 In addition to the equipment above, a cellular telephone will be located in a designated support zone and verified to be in working order prior to start of work.

12.2.1.3 First-Aid Procedures

The following first-aid procedures will be followed when on-site first-aid personnel must render assistance for individuals injured on site.

- For minor injuries, use routine first-aid procedures.
- For major injuries, call an ambulance immediately and administer the appropriate first-aid while awaiting arrival of the ambulance.
- Use Red Cross-approved measures for first-aid treatment.
- Wash or rinse affected area thoroughly with copious amounts of soap and water, then provide appropriate medical attention if required.

- If chemicals have been splashed into the eyes, rinse eyes for at least 15 minutes.
- If illness or injury involves the inhalation of hazardous materials, move victim to fresh air and, if necessary, decontaminate and transport to hospital.
- For any injury or illness involving exposure to hazardous chemicals, decontaminate the victim and transport to the hospital for professional medical attention.
- The UXOQC/SO will provide personnel data sheets to appropriate medical personnel as requested.

12.2.1.4 First-Aid Kits

The size and number of kits, which include first aid and eye wash supplies and a CPR mask, will be sufficient to accommodate the maximum number of people (including government personnel and visitors) on site at any given time. The kits will be located at each work site and the location will be made known to all personnel. An additional kit will be kept with the designated first-aid/CPR attendant or with the UXOQC/SO. Kit locations will be provided with adequate water and other supplies necessary to clean burns, wounds, or lesions.

12.2.1.5 Emergency Response Plan Testing

The emergency response plan shall be tested prior to commencing site operations to ensure its adequacy. This test shall include a person with simulated injury who is transported to the supporting medical facility.

12.2.2 Chemical Spill and Discharge Containment Plan (01.E.01, 06.A.02)

The immediate containment of spilled hazardous materials is required to minimize the impact on human and environmental health. This plan provides the methods and activities to protect the environment in case of a hazardous material spill.

12.2.2.1 Planning

Planning ensures the proper response to any emergency, including a chemical spill. To properly plan a response, it is important to identify the response team members, their response roles, the potential chemicals involved, the potential pathways of the hazardous materials into the environment, and the properties of the hazardous material.

12.2.2.2 Spill Prevention

Prevention is the best method of controlling the potential effects of hazardous materials on the environment. The most important aspects of prevention are training and communication. Should a spill occur, properly trained personnel will be able to react to the spill and know what actions to take to protect human health and the environment. Communication includes marking all drums or containers with the contents, the associated hazards of the hazardous material, and the hazard rating. Information from material safety data sheets (MSDSs) for any chemicals brought on site are available and should be used in the event of a spill.

12.2.2.3 Spill Action Control Plan

12.2.2.3.01 In the event of a large spill or discharge, the contracting officer's representative, EEG's QC manager and health and safety director, and any appropriate government agency will be notified within 48 hours of the spill. Measures to control and contain the spill will be implemented immediately. The measures to be taken in the event of a spill include but are not limited to the following.

- Isolate and contain the source.
- Deny entry to unauthorized personnel.
- Place the control station upwind and keep out of low-lying areas.
- Keep combustibles and reactive materials away from the spill.
- Place contaminated solid materials into sealable containers in a manner that would prevent leakage of the contaminated materials.
- Contain liquid materials by damming with a boom or using a non-combustible absorbent. The absorbent material will then be placed into a sealable container for characterization and disposal.
- Place excavated soil either in a sealable container (small quantities) or in a plastic-lined and bermed stockpile. The stockpile will be covered with plastic.

12.2.2.3.02 Site operations should not involve handling large containers of hazardous materials that could easily be spilled; however, small containers (5 gallons or less) of gasoline, solvent, or diesel fuel may be used and stored on site. Only portable industrial-use gasoline containers approved by OSHA shall be used. No standard plastic containers shall be used. If material from these containers is spilled, the following steps will be taken.

- Evacuate the immediate area and extinguish ignition sources.
- The UXOQC/SO will evaluate the situation to ensure it is safe for personnel to begin cleanup operations.

- Using non-sparking or appropriately grounded tools, collect the contaminated soil and place it in a plastic bag, which will then be placed in a 55-gallon Department of Transportation (DOT)-approved drum.
- The UXOQC/SO will notify the appropriate USACE site representative that the spill occurred and await guidance on disposal of the drummed contaminants.

12.2.3 Firefighting Plan (01.E.01, 19.A.04)

12.2.3.1 Fire Extinguishers

A dry chemical type 4A:20B:C fire extinguisher will be available at each work site. Dry chemical fire extinguishers will be provided at any other site location where flammable materials may present a fire risk. Additionally, a fire extinguisher rated at least 1A:10B:C will be located with each piece of heavy equipment and in each site vehicle.

12.2.3.2 Small Fires

A small fire is defined as a fire that can be extinguished with a type 4A:20B:C fire extinguisher. In the event of a small fire, site personnel will:

- Evacuate all unnecessary personnel from the area, preferably to an upwind location.
- Attempt to extinguish fire using portable fire extinguishers or by smothering from an upwind location. (**Note:** Do not attempt to extinguish a fire involving explosives or explosive liquids.)
- Request emergency response assistance (i.e., ambulance, fire, and police), as needed, for any injuries or exposures to hazardous chemicals.

12.2.3.3 Large Fires

In the event of a large fire, or a small fire that cannot be extinguished, the following actions will be taken.

- Evacuate all unnecessary personnel from the site, preferably to an upwind location.
- Notify the fire department or other emergency response service (i.e., police, fire, ambulance, and hospital), as needed.
- Advise local fire department personnel as required.

12.2.3.4 Explosion

In the event of an explosion, all non-essential personnel will evacuate the site, required support equipment and personnel will be requested, and the CEHNC representative will be notified.

12.2.4 Posting of Emergency Telephone Numbers (01.E.05)

The list of the emergency phone numbers (**Table 12-3**) will be readily available to all employees on the job site, and all phone numbers will be able to be reached via cellular phone. All personnel will be aware of the location of the closest telephone access.

Table 12-3. Emergency Telephone Numbers

Agency or Facility	Personnel	Telephone Number
Coast Guard	Duty Officer	(787) 729-2301
Municipality of Culebra Police	Duty Officer	(787) 742-3501/0106
Culebra Medical Clinic	Duty Officer	(787) 742-3511
San Pablo del Este Hospital, Fajardo	Duty Staff	(787) 863-0505 (main), ext. 1141 (emergency)
		(787) 740-0333 (direct emergency number)
Municipality of Culebra Fire Department	Duty Officer	(787) 742-3530
Cuerpo de Vigilantes	Duty Officer	(787)742-0720
EEG Project Manager / Health & Safety Director	Mark Bagel	(352) 332-3888
USACE Jacksonville Project Manager	Ricardo Vasquez	(904) 232-1649
USACE Huntsville Project Manager	Brendan Slater	(256) 895-1507
Poison Control Center	Duty Officer	(800) 282-3171
National Response Center	Duty Officer	(800) 424-8802
Centers for Disease Control, Atlanta, GA	Duty Officer	(800) 232-0124

12.2.5 Man Overboard / Abandon Ship (19.A.04)

Transport by boat will be required for clearance operations on Isla Culebrita and additional cays that are accessible only via boat. All employees working on or near the water will wear a USCG-certified personal flotation device (PFD) all times and will use additional PPE such as lanyards and/or safety nets as necessary. Throwable devices must be immediately available for use. Requirements for PFD use are as follows.

- Wearable PFDs must be readily accessible.
- PFDs must be able to be put on in a reasonable amount of time in an emergency (vessel sinking, on fire, etc.).
- PFDs should not be stowed in plastic bags or in locked or closed compartments, or have other gear stowed on top of them.

12.2.5.1 Man Overboard

12.2.5.1.01 All personnel should know what to do if they fall overboard and what action the ship will take to rescue someone in the water. If a person falls overboard, depending on the temperature of the water, hypothermia can set in rapidly. Precautionary measures will be taken to help slow down loss of body heat, including staying calm in the water, tucking legs into the upper body, and keeping the head above water.

12.2.5.1.02 If a man overboard is observed, the following procedures apply.

- Shout out "Man overboard, port or starboard side."
- Throw life rings, life jackets, or any floating gear over the side as near a possible to the person.
- Make sure that the captain is notified by the quickest means possible.
- Make sure that you or a crew member keeps an eye on the person at all times and points to the person with an extended arm. This is so you do not lose track of the person and so the captain can use your extended arm as a reference point to maneuver the ship for recovery. If you have a vital man overboard station, then go to your station when you are relieved from keeping track of the person in the water.

12.2.5.2 Abandon Ship

12.2.5.2.01 EEG personnel shall:

- Fall in at your station as quickly as possible, in a military manner, observing traffic routes.
- Don survival suits (if applicable) and secure them properly.
- Remember the bearing and distance to the nearest land.
- Stay together with your group.

12.2.5.2.02 When orders are given to abandon ship, the following procedures apply.

- When the order "All hands make preparations to abandon ship" is given, proceed topside and put on a survival suit.
- Personnel in charge of life raft stations will direct the release and lowering of boats, rafts, nets, and ladders.
- If time permits, all hands should throw anything that floats over the side.
- Proceed over the side in an orderly manner.

- Enter the water on the windward side. This will cause the ship and debris in the water to drift away from you.
- Use lines, ladders, hoses, or debarkation nets to lower yourself into the water. Jumping into the water should be the last resort.
- Wear a soft hat, shoes, and full uniform with a long sleeve shirt, if possible, for protection.

12.2.5.2.1 Survival in the Water

- Stay approximately 200 yards from the ship. This distance will provide safety form suction, debris, and any underwater explosions that may occur.
- Temporary flotation can be provided by inflating your trousers, shirt, or even a pillow case.
- It is common belief that someone dressed in heavy clothing or waders will sink immediately if they fall overboard. This is not true. Air trapped in clothing provides considerable flotation, and bending the knees will trap air in waders, providing additional flotation. To stay afloat follow these rules:

  —Remain calm, do not thrash about or try to remove clothing or footwear. This leads to exhaustion and increases the loss of air that keeps you afloat.

  —Keep your PFD on.

  —Keep your knees bent.

  —Float on your back and paddle slowly to safety.
- Stay in a group, huddled together.
- To prevent shark attack, remain calm and remove jewelry.

12.2.5.2.2 Survival in a Life Raft

- Wounded and sick personnel have priority in the rafts.
- Redistribute the load in each raft if necessary. Rescue chances will be improved if the rafts stay together.
- Fresh water will be given only after the first 24 hours. Do not drink salt water.
- A strong desire or will to live and staying calm will increase your chances of survival.

12.2.5.2.3 Techniques for Attracting Other Vessels and Aircraft

- Pyrotechnics are provided for day and night use. Follow the instructions found on the labels. Release the pyrotechnic with the wind at your back and your arm extended away from the raft at a 45-degree angle. If a pyrotechnic device fails to fire, attempt to discharge it one more time. If it fails again, dispose of the cartridge overboard.

- Some other items provided are a signal mirror, dye markers, smoke flares, flashlights, and police whistles.

12.3 Hazard Communication Program (01.B.06)

12.3.01 EEG recognizes the importance of documentation, inventory, labeling, and training with regard to chemicals brought onto job sites. The purpose of EEG's Hazard Communication Program is to evaluate the potential hazards associated with chemicals and to communicate this information to site workers as required under 29 CFR 1926.59.

12.3.02 Subcontractors are responsible for providing their own program, which must meet or exceed the requirements set forth in EEG's program, or must use EEG's program. Subcontractors are required to submit a copy of their program to EEG upon request. Subcontractors are required to provide a list of chemicals and submit this list along with appropriate MSDSs to the UXOQC/SO prior to beginning work on a project. In addition, subcontractors are required to update and resubmit this list whenever a new chemical is brought onto the project site.

12.4 Critical Lift Procedures (16.C.18)

Care must be taken in lifting and handling heavy or bulky items because they are the cause of many joint and back injuries. The following fundamentals address the proper lifting of materials to avoid joint and back injuries.

- The size, shape, and weight of the object to be lifted must be considered.
- Site personnel will not lift more than they can handle comfortably.
- Individual workers should not normally lift loads in excess of 40 pounds.
- A firm grip on the object is essential; therefore, the hands and object shall be free of oil, grease, and water, which might prevent a firm grip.
- The hands and fingers shall be kept away from any points that cause them to be pinched or crushed, especially when setting the object down.
- The item shall be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces, and pinch points, and gloves shall be used, if necessary, to protect the hands.
- The feet shall be placed far enough apart for good balance and stability; Personnel will ensure that solid footing is available prior to lifting the object.

- Personnel shall get as close to the load as possible and bend the legs at the knees, making sure to keep the back as straight as possible. To lift the object, the legs are straightened from their bending position.
- Personnel shall not carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting, with the back kept straight and the legs bent at the knees.
- When two or more people are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load.
- When carrying the object, each person, if possible, shall face the direction in which the object is being carried.

12.5 Contingency Plan for Severe Weather (19.A.03)

Severe weather, including thunderstorms and associated lightning as well as hurricanes, is a common feature of the region; therefore, meteorological conditions will be closely watched. A weather radio will be used on site to monitor for severe weather conditions. Thunderstorms often occur late in the afternoon on hot days, but they can occur at any time of the day and in any season of the year. A severe thunderstorm or tornado watch announcement on the radio or television indicates that a severe thunderstorm or tornado is possible. Work will continue at the work site during the watches. A severe thunderstorm or tornado warning signifies that a severe thunderstorm or a tornado has been sighted or detected by radar and may be approaching. All on-site work will cease during a thunderstorm, severe thunderstorm warning, or tornado warning. **Table 12-4** defines severe weather watches and warnings.

Table 12-4. Severe Weather Watches and Warnings

Weather Event	Watch	Warning
Tornado	Conditions are conducive to the development of tornadoes in and close to the watch area.	A tornado has actually been sighted by spotters or indicated on radar and is occurring or imminent in the warning area.
Severe thunderstorm	Conditions are conducive to the development of severe thunderstorms in and close to the watch area.	A severe thunderstorm has actually been observed by spotters or indicated on radar, and is occurring or imminent in the warning area.
Tropical storm	Tropical storm conditions with sustained winds from 39 to 73 miles per hour (mph) are possible in the watch area within the next 36 hours.	Tropical storm conditions are expected in the warning area within the next 24 hours.
Hurricane	Hurricane conditions (sustained winds greater than 73 mph) are possible in the watch area within 36 hours.	Hurricane conditions are expected in the warning area in 24 hours or less.

12.5.1 Weather Monitoring

12.5.1.01 In the event of inclement weather, electrical storms, hurricanes, or extremely hot weather, it may be necessary to cease operations and evacuate the site. The UXOQC/SO and the site manager will be responsible for monitoring the National Oceanic and Atmospheric Administration (NOAA) weather radio on a daily basis and advising site personnel of the forecast. A 300-watt NOAA weather radio transmitter (Weather Radio Station WNJ-693) installed at Mt. Flamenco on Culebra broadcasts on a frequency of 162.450 megahertz. In the event of adverse weather, the UXOQC/SO will determine if work can continue without sacrificing the health and safety of site personnel. Items to be considered in determining whether would should continue include:

- Heavy rainfall
- Electrical storms
- Potential for heat stress
- Potential for accidents
- Approaching hurricanes
- Malfunctioning of monitoring equipment
- Limited visibility

12.5.1.02 Forecasts will also be monitored on the Internet by reviewing the daily forecasts at NOAA National Hurricane Center (http://www.nhc.noaa.gov/); the NOAA National Weather Forecast Office, San Juan (http://www.srh.noaa.gov/sju/); or the Caribbean Hurricane Network (http://stormcarib.com/).

12.5.1.03 Significant weather forecasts will be presented and discussed at the daily morning safety briefing and an appropriate course of action implemented. Because Culebra is relatively isolated, it may be necessary to commence preparations for significant tropical events well in advance of 72 hours out.

12.5.2 Hurricane and Tropical Storm Readiness

12.5.2.01 The hurricane season for the Puerto Rico and Culebra area is June 1 through November 30. The period of greatest frequency and severity of tropical storms is typically September and October. Fajardo, Puerto Rico, the closest area on the mainland from Culebra, is on average brushed or hit every 3.62 years, with an average of a direct hurricane hit every 11.6 years.

12.5.2.02 Maintaining an adequate state of readiness requires, at a minimum, *continuous* good housekeeping at the work site, proper material storage, tie-down provisions for office trailers, sheds, etc., and other measures as may be appropriate to the particular nature of the contract work. Throughout the *entire* hurricane season, all work, including material storage, placement of construction debris, and management of the work, will be performed in such a manner as to allow personnel to rapidly achieve the hurricane condition of readiness required.

12.5.2.1 Hurricane Categories

12.5.2.1.01 The intensity of a land-falling hurricane is expressed in terms of categories that relate wind speeds and potential damage. **Table 12-5** presents hurricane categories as rated on the Saffir-Simpson scale.

Table 12-5. Hurricane Categories

Category	Wind Speed	Potential Damage
Category 1	74 to 95 mph (64 to 82 knots)	No real damage to buildings. Damage to unanchored mobile homes. Some damage to poorly constructed signs. Some coastal flooding and minor pier damage.
Category 2	96 to 110 mph (83 to 95 knots)	Some damage to building roofs, doors and windows. Considerable damage to mobile homes. Flooding damages piers and small craft in unprotected moorings may break their moorings. Some trees blown down.
Category 3	111 to 130 mph (96 to 113 knots)	Some structural damage to small residences and utility buildings. Large trees blown down. Mobile homes and poorly built signs destroyed. Flooding near the coast destroys smaller structures with larger structures damaged by floating debris. Terrain may be flooded well inland.
Category 4	131 to 155 mph (114 to 135 knots)	More extensive curtainwall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland.
Category 5	156 mph and up (135+ knots)	Complete roof failure on many residences and industrial buildings. Some complete building failures, with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required.

12.5.2.1.02 Typical hurricanes are about 300 miles wide although they can vary considerably. Size is not necessarily an indication of hurricane intensity, and focus should not be on the location and track of the center, because a hurricane's destructive winds and rains cover a wide swath. Hurricane-force winds can extend outward to about 25 miles from the storm center of a small hurricane and to more than 150 miles for a large one. The area over which tropical storm-force winds occur is even greater, ranging as far out as almost 300 miles from the eye of a large hurricane.

12.5.2.1.03 The main hazards associated with tropical cyclones and especially hurricanes are storm surge, high winds, heavy rain, and flooding, as well as tornadoes. The intensity of a hurricane is an indicator of damage potential; however, impacts are a function of where and when the storm strikes.

12.5.3 Evacuation Plan

12.5.3.01 The site manager and the UXOQC/SO will track the approach of severe storms. Once an oncoming tropical depression is indicated, the site manager will notify the project manager of this condition. The UXOQC/SO will coordinate with the local Civil Defense personnel to determine which shelters the team may be able to occupy should an evacuation order be issued.

12.5.3.02 If the tropical depression reaches tropical storm strength, EEG project manager will notify the CEHNC project manager concerning the potential of shutdown due to the storm. The EEG project manager will provide the CEHNC project manager with an evaluation of the conditions and the potential costs in terms of time and budget to demobilize or stay, based on the strength of the storm and damage potential to the island. A decision to stay or leave the site must be made within three days of projected landfall if full evacuation from Puerto Rico is suggested.

12.5.3.03 The EEG UXOQC/SO and the site manager will determine and declare the hurricane condition and begin implementation of the following schedule (the conditions are based on DoD facility guidance).

12.5.3.1 Seasonal Condition

This condition is a normal condition of alertness, consistent with the dictates of sound precautionary measures to be exercised during the hurricane season (June 1 to November 30). This condition will be effective throughout the hurricane season.

12.5.3.2 Hurricane Condition IV

Trend indicates a possible threat of destructive winds of force indicated within 72 hours. Personnel must have on the job site sufficient hurricane gear such as ropes, stakes, and tarpaulins to securely fasten all stockpiles of materials, tools, and equipment. The site shall be cleared of all waste material that may become windborne. All trash and debris must be immediately removed from the site.

12.5.3.3 Hurricane Condition III

Destructive winds in excess of 64 knots or greater associated with a tropical system are anticipated within 48 hours. Personnel will remove or store unnecessary materials and will check to make sure that sufficient hurricane gear is on hand so that every item or materials that could become windborne can be securely tied down on short notice. When an island or installation is put under a hurricane watch or DoD Condition III level (destructive winds possible within 48 hours), EEG will begin hurricane preparations.

12.5.3.4 Hurricane Condition II

Destructive winds in excess of 64 knots or greater associated with a tropical system are anticipated within 24 hours. EEG personnel will make such preparations as will enable all work to be completely secured within 12 hours. All materials not immediately required shall be removed or securely tied down. All openings shall be closed except those necessary to permit access to the work currently under way. All trash and debris shall be removed or stored on site. Work will continue until directed by the site manager to secure the site.

12.5.3.5 Hurricane Condition I

12.5.3.5.01 Destructive winds in excess of 64 knots or greater associated with a tropical system are anticipated within 12 hours. EEG personnel will evacuate the site and take all possible precautions to safeguard personnel, project records, and property. The UXOQC/SO will order the complete security of the contract work when the hurricane is expected to reach the local area within 12 hours. When the UXOQC/SO orders “complete security,” all work will stop and personnel will completely secure the project. All project personnel will secure material that may become windborne or dispersed by high winds. Buildings, structures, or portions thereof shall be braced where necessary, and openings closed will be closed.

12.5.3.5.02 At minimum, the following items should be taken when evacuating:

- Prescription medications and medical supplies
- Bedding and clothing, including sleeping bags and pillows
- Bottled water, battery-operated radio and extra batteries, first aid kit, flashlight
- Important project documents and data

12.6 Access and Haul Road Plan (8.D.1)

12.6.01 Cerro Balcon (OOU-3) is located on private agricultural land in the interior of the Island of Culebra. Rights of entry to conduct the surface clearance operations must be obtained prior to site work. A private, gated, dirt road runs into the site from the paved public access road. All staging will be conducted from inside the gate along the side of the dirt road. This dirt road will be used for all site ingress and egress.

12.6.02 Isla Culebrita (OOU-4) and the additional cays (OOU-5) are administered by FWS and are accessible only by boat. No heavy equipment or vehicles will be utilized on these sites. All equipment will necessarily be carried in by hand. All access points and travel paths will be determined following the site visit and in consultation with FWS.

12.7 Safety and Health Plan (28.A.02)

See the Site-Specific Health and Safety Plan for this project (Attachment A).

12.8 Blasting Plan (29.A.01)

Elements of the Blasting Plan are discussed in Chapters 3 and 4 of the Work Plan.

12.9 Plan for Prevention of Alcohol and Drug Abuse (DFARS Subpart 252.223-7004)

12.9.1 Purpose

12.9.1.01 EEG recognizes the dangers that the abuse of alcohol and/or drugs can have on the performance of its employees and on the safety and security of its work environment. EEG will therefore test, at its expense, all newly hired employees for drug and/or alcohol use as outlined in this plan. Further, EEG will test, at company expense, any current employees for drug or alcohol use if a reasonable suspicion exists that the employee is in violation of this plan, as a regular part of fitness for duty examinations, after a work-related injury, and as a follow-up procedure to any drug or alcohol treatment program. If an employee receives a positive result, that employee may be subject to discipline up to and including termination of employment. All drug testing will conform to the requirements of this plan and to state and federal law.

12.9.1.02 EEG recognizes that drug and/or alcohol abuse (substance abuse) is treatable and is committed to making an effort to assist current employees who may be experiencing problems due to substance abuse, by helping them to understand and correct it, while supporting approved rehabilitation efforts.

12.9.1.03 Additionally, under Public Law 100-690, Title V, in conjunction with the Drug Free Workplace Act of 1988 and/or in compliance with the Drug Free Workplace, State of Florida Workers' Compensation Act 59A-24.003(7) FAC [Florida Administrative Code], Section 112.0455(13), and 440.102, FS [Florida Statue], and/or in compliance with the DOT regulations in this industry, EEG is obligated to establish and communicate its policy on drug and alcohol use to all employees.

12.9.2 Policy

12.9.2.1 Condition of Employment and/or Continued Employment

It is EEG's policy to maintain a drug-free workplace as a condition of employment and/or continued employment. All employees must abide by the terms of this policy.

12.9.2.2 Drug and/or Alcohol Use Prohibitions

The use, sale, manufacture, distribution, purchase, possession, dispensing, or being under the influence of illegal drugs, non-prescribed controlled substances, or alcohol on company property, while on company business, or while operating a company-owned or leased vehicle is strictly prohibited. Employees found to be in violation of this policy will be subject to discipline up to and including termination of employment. Any illegal drugs found on company property will be turned over to the appropriate law enforcement authorities.

12.9.2.3 Testing

In order to detect the use of these substances, as described above, employees may be directed to submit to a urinalysis drug test, a blood test, and/or breath test. Individuals under the influence of alcohol or with illegal or non-prescribed controlled drugs in their system are in violation of this policy and will be subject to discipline up to and including termination of employment.

12.10 Fall Protection Plan (Section 21)

Personal fall protection devices shall be utilized at all times when an individual is elevated above 6 feet or more above the ground level. Personal fall arrest systems shall be required when working on steep slopes. Fall protection shall comply with American National Standards Institute (ANSI) A10.14.

12.10.1 Working Over or Near Water (CFR 1926.106)

12.10.1.01 Employees working over or near water where the danger of drowning exists shall be provided with USCG-approved life jackets or buoyant work vests. Before and after each use, the buoyant work vests or life preservers shall be inspected for defects that would alter their strength or buoyancy. Defective units shall not be used.

12.10.1.02 Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. Distance between ring buoys shall not exceed 200 feet.

12.10.1.03 At least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water.

12.11 Site Sanitation Plan (Section 02)

See the Site-Specific Health and Safety Plan (Attachment A).

12.12 Fire Prevention Plan (09.A.01)

See the Site-Specific Health and Safety Plan (Attachment A).

13.0 Site-Specific Hazards and Controls

13.0.01 For each type of activity that will be performed on this project, an activity hazard analysis has been performed and Certification of Activity Hazard Analysis form completed to provide a task-specific evaluation of the known or potential hazards associated with the conduct of the individual activity. The UXOQC/SO will use these forms daily to inform site personnel of the hazards expected during the day's activities.

13.0.02 The completed Certification of Activity Hazard Analysis form also outlines the engineering and administrative controls, operating procedures or programs, and PPE that will be required for the safe conduct of the particular activity.

13.0.03 The hazard analyses have been conducted using the best available information related to the site and the nature of the task itself. If site conditions or tasks change, the UXOQC/SO will evaluate the new condition or task and complete a new Certification of Activity Hazard Analysis form. The UXOQC/SO will then forward the form to the EEG certified industrial hygienist (CIH) for approval prior to resuming or initiating the task.

Table 13-1. Activity Hazard Analysis

ACTIVITY: Location Survey, and Mapping

ANALYZED BY/DATE: MGB 4/16/05

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
1. Cutting vegetation for line of site. 2. Use of global positioning system (GPS) or conventional survey equipment to locate boundaries. 3. Installation of control point (rods) and corner stakes.	1. Physical exertion. 2. Heat stress. 3. Slip, trip, or fall. 4. Poisonous plants. 5. Poisonous/hazardous animals. 6. MEC 7. Chemical hazard – low. 8. Physical hazard – low. 9. Hand or power tools. 10. Puncture or laceration.	1. Drink plenty of liquids. 2. A qualified UXO technician will perform MEC avoidance. 3. Site personnel will remain aware of the potential for injury from contact with the stumps of small trees and bushes with thorns. 4. Electromagnetic survey for surface items. 5. Visual inspection for MEC, use of electromagnetic device prior to potential intrusive activities (i.e., pounding stakes). 6. Wear the correct shoes for weather conditions (i.e., mud, rain, uneven surfaces). 7. Keep area clear of clutter. 8. Carry small instead of large loads.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
1. Level D protection. 2. Leather gloves. 3. Safety glasses required if an eye hazard exists. 4. Leather high boots are adequate. 5. Electromagnetic sensors. 6. Hammer. 7. Machete or weed eater with blade.	1. Inspect for safety of operations. 2. Inspect blades for sharpness and/or damage. 3. Ensure that all guards are present on power tools. 4. Inspect area prior to driving stakes.	1. Tailgate safety briefing. 2. Site-specific safety indoctrination. 3. UXO-trained personnel will supervise this activity.

Table 13-1. Activity Hazard Analysis (continued)

ACTIVITY: Vegetation Clearing using Chain Saw or Bladed Weed Eater **ANALYZED BY/DATE:** MGB 4/16/05

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
1. Fuel equipment. 2. Start equipment. 3. Safety spotter to watch for hazards. 4. Cut vegetation. 5. Move vegetation off work site.	1. Physical exertion. 2. Heat stress. 3. Fire hazards (flammable materials). 4. Lifting hazards. 5. Slip, trip, or fall. 6. High noise (greater than 85 dBA). 7. Poisonous plants. 8. Poisonous or hazardous animals. 9. Hand or power tools. 10. MEC. 11. Puncture or laceration.	1. Safe work practices 2. PPE for chain saw and weed eater. 3. Site control zones. 4. Electromagnetic survey for surface items. 5. Applicable machine guards will be in place. 6. EOD-trained personnel on site to identify potential MEC items. 7. Wear the correct shoes for weather conditions (i.e. mud, rain, uneven surfaces). 8. Reduce clutter as possible. 9. Carry small instead of large loads.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
1. Level-D protection modified by the mandatory addition of ear plugs or muffs and wire mesh face shields. 2. Leather gloves. 3. Hard hat when cutting vegetation and limbs. 4. Composite-toed boots. 5. Steel-toe/metatarsal covers used with approval of UXOQC/SO. 6. Kevlar leg chaps. 7. Bobcat or Bulldozer may be used to remove vegetation. 8. Chain saw. 9. Bladed weed eater.	1. Safety inspection by UXOQC/SO. 2. Periodically inspect blades for sharpness and/or damage. 3. Inspect area for MEC.	1. Site-specific safety indoctrination for all personnel. 2. UXO-trained personnel will supervise this activity 3. All vegetation clearance personnel will have HAZWOPER training. 4. Tailgate safety briefing.

Table 13-1. Activity Hazard Analysis (continued)

ACTIVITY: Electromagnetic Assisted Visual Clearance **ANALYZED BY/DATE:** MGB 5/16/05

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
1. Check equipment to a known source. 2. Walk grid and work area in lanes 5 feet apart, swinging the electromagnetic sensor in a minimal 5-foot arc less than 6 inches from the ground. 3. Place and mark MEC with flags as necessary.	1. Physical exertion. 2. Heat stress. 3. Lifting hazard. 4. Slip, trip, or fall. 5. Poisonous or hazardous animals. 6. Poisonous plants. 7. MEC. 8. Puncture or laceration. 9. Chemical hazard – low. 10. Physical hazard – medium.	1. Safe work practices. 2. PPE. 3. Set up site control zones. 4. Electromagnetic survey. 5. Site personnel will remain aware of the potential for injury from contact with the stumps of small trees and bushes that have been grubbed. 6. Wear the correct shoes for weather conditions (i.e., mud, rain, uneven surfaces). 7. Keep area clear of clutter. 8. Carry small instead of large loads.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
1. Level D protection. 2. Company clothing. 3. Hard hats required if an overhead hazard exists. 4. Safety glasses required if an eye hazard exists. 5. Leather boots. 6. Composite-toed boots required if a crush hazard exists.	1. Inspect area for slip, trip, or biological hazards. 2. Inspect area for endangered species habitats.	1. Tailgate safety briefing. 2. Site-specific safety indoctrination. 3. UXO-trained personnel will supervise this activity. 4. HAZWOPER training.

Table 13-1. Activity Hazard Analysis (continued)

ACTIVITY: Intrusive Investigation of Partially Buried MEC **ANALYZED BY/DATE:** MGB 4/16/05

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
1. Carefully excavate around MEC. 2. Identify type and condition. 3. Document the location of MEC items by GPS or mapping. 4. Determine the condition and disposal method of item.	1. Physical exertion. 2. Heat stress. 3. Slip, trip, or fall 4. Intrusive activity (hand excavation of material potentially presenting an explosive hazard [MPPEH]). 5. Poisonous plants. 6. Poisonous or hazardous animals. 7. Hand or power tools. 8. MEC. 9. Chemical hazard – low. 10. Physical hazard – moderate.	1. Safe work practices. 2. PPE. 3. Site control zones. 4. Visual clearance. 5. Applicable programs: heat stress, hearing conservation, and the Accident Prevention Plan. 6. Wear the correct shoes for weather conditions (i.e., mud, rain, uneven surfaces). 7. Reduce clutter 8. Carry small instead of large loads. 9. If heavy equipment is being used, digging will not be allowed within 12 inches from MPPEH, and hand tools will be used to finish.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
1. Level D protection. 2. Company clothing. 3. Leather gloves. 4. Safety glasses required if an eye hazard exists. 5. Composite-toed leather boots. 6. Excavation tools (i.e., shovels, picks, rakes, and heavy equipment).	1. Inspect the condition of MEC and assess the hazard. 2. Inspect the area for hazards prior to work.	1. UXO technicians will be UXO-trained. 2. Tailgate safety briefing 3. All personnel will have site-specific safety indoctrination 4. Persons working with UXO will have HAZWOPER training. 5. Operator of heavy equipment will be trained to use that equipment.

Table 13-1. Activity Hazard Analysis (continued)

ACTIVITY: Heavy Equipment Operation (backhoe, Bobcat, and bulldozer) **ANALYZED BY/DATE:** MGB 4/16/05

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
1. Fueling the equipment. 2. Check equipment for proper safety equipment. 3. Excavate or move soil in shallow lifts. 4. Screen excavated area with geophysical locator to ensure that no MPPEH is detected. 5. When in motion, properly observe personnel in the area.	1. Crush hazard by heavy equipment. 2. Physical exertion. 3. Heat stress. 4. Slip, trip, or fall. 5. Intrusive activity (hand excavation of MPPEH). 6. Poisonous plants. 7. Poisonous or hazardous animals. 8. MEC. 9. Chemical hazard – low. 10. Physical hazard – moderate.	1. Safe work practices. 2. PPE. 3. Site control zones. 4. Electromagnetic survey. 5. Visual clearance. 6. A spotter will be used to help locate personnel around the equipment while moving. 7. Applicable machine guards will be in place. 8. Shut down equipment or unit before refueling. 9. Clean the clutter from poor housekeeping.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
1. Bulldozer. 2. Backhoe. 3. Hand tools. 4. Level D protection. 5. Company clothing. 6. Leather gloves. 7. Safety glasses required if an eye hazard exists. 8. Composite-toed leather boots. 9. Hard hats when applicable.	1. Inspect equipment for safety function. 2. Inspect area of operation for hazards.	1. Operator will be properly trained to work equipment. 2. Personnel on site during excavation will be UXO-trained. 3. UXO-trained personnel will supervise this activity. 4. Site-specific safety indoctrination.

Table 13-1. Activity Hazard Analysis (continued)

ACTIVITY: Explosive Disposal of UXO

ANALYZED BY/DATE: MGB 4/16/05

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
1. Transport explosives to the site. 2. Attach explosives in a manner that will detonate or explosively vent the item. 3. Tamp the item with sandbags to limit the noise and fragments produced. 4. Check area for unauthorized personnel, boats, or aircraft within specified distance from the demolition area. 5. Warn personnel in area prior to detonating explosives 6. Detonate explosives.	1. Physical exertion. 2. Heat stress. 3. Heavy equipment. 4. Fire hazards (explosive materials). 5. Lifting hazards. 6. Slip, trip, or fall. 7. Intrusive activity (soil excavation for demolition pit). 8. Poisonous plants. 9. Poisonous or hazardous animals. 10. MEC. 11. Explosive detonation.	1. Safe work practices. 2. PPE. 3. Site control zones. 4. Explosive items will be tamped with sand bags to reduce blast and noise hazards. 5. Vehicles not running, wheels chocked, brakes set when loading and unloading 6. Explosives covered with flame-resistant tarpaulin. 7. Vehicles have first aid kit, fire extinguisher (2 each @ 10BC), and communication capability on personnel. 8. Do not allow explosives to contact vehicle metal bed. 9. Licensed drivers will not exceed 25 mph off-road speeds. 10. Wear the correct shoes for weather conditions (i.e., mud, rain, uneven surfaces). 11. Clean the clutter from poor housekeeping. 12. Carry small instead of large loads. 13. Tamp shots whenever possible. 14. Wet ground prior to demolition operations.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
1. Level D protection. 2. Non-sparking tools. 3. Safety glasses required if an eye hazard exists. 4. Leather composite-toed boots if a crush hazard exists. 5. Dunnage, sand bags, wooden box, non-sparking bed liner, flame resistant tarp. 6. Water truck and/or centrifugal pump.	1. Inspect area for hazards prior to work. 2. Inspect MEC item to ensure that the explosives have been properly attached. 3. After detonation, inspect item to ensure that all explosive materials have been vented or the item is completely destroyed. 4. Inspect vehicles prior to explosive movement. 5. Ensure that personnel are not wearing clothing made of synthetic fiber that is static-producing.	1. Site-specific safety indoctrination. 2. Fully trained and qualified UXO technician will perform this task. 3. Tailgate safety briefing. 4. Demolition operations briefing. 5. HAZWOPER training. 6. Explosive detonation training.

Table 13-1. Activity Hazard Analysis (continued)

ACTIVITY: Bobcat-Mounted Bush Hog or Similar Equipment

ANALYZED BY/DATE: MGB 4/16/05

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
1. Fueling the equipment. 2. Check equipment for proper safety. Set mower blade to minimum height of 12 inches. 3. Screen area where vegetation is cut prior to moving up vehicle. 4. When in motion, properly observe personnel in the area.	1. Crush hazard by heavy equipment. 2. Physical exertion. 3. Heat stress. 4. Slip, trip, or fall. 5. Poisonous plants. 6. Poisonous or hazardous animals. 7. MEC. 8. Chemical hazard – low. 9. Physical hazard – moderate.	1. Safe work practices. 2. PPE. 3. Site control zones. 4. Electromagnetic survey. 5. Visual clearance. 6. Site personnel will remain aware of the potential for injury from contact with the stumps of small trees and bushes that have been grubbed. 7. Applicable machine guards will be in place. 8. Limit mower to a minimum height of 12 inches above ground. 9. Shut down equipment or unit before refueling. 10. Wear the correct shoes for weather conditions (i.e., mud, rain, uneven surfaces). 11. Clean the clutter. 12. Carry small instead of large loads.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
1. Bush Hog. 2. Tractor. 3. Hand tools. 4. Level D protection. 5. Company clothing. 6. Leather gloves. 7. Safety glasses required if an eye hazard exists. 8. Composite-toed leather boots. 9. Hard hats if applicable.	1. Inspect equipment for safety function. 2. Inspect area of operation for hazards. 3. Inspect the blades for sharpness and/or damage.	1. Personnel will be properly trained to operate equipment. 2. UXO technician will supervise this activity. 3. Site-specific safety indoctrination.

Table 13-1. Activity Hazard Analysis (continued)

ACTIVITY: Scrap Handling and Removal **ANALYZED BY/DATE:** MGB 4/16/05

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
1. Fueling the equipment. 2. When in motion, properly observe personnel in the area. 3. Lifting scrap. 4. Filling and sealing drums. 5. Lifting drums with heavy equipment.	1. Fuel spill or fire. 2. Crush or pinch hazard while in motion or while moving drums. 3. Puncture from sharp pieces of fragments or plants. 4. Heat stress. 5. Physical exertion. 6. Slip, trip, or fall. 7. Poisonous or hazardous plants and animals. 8. Munitions debris. 9. Chemical hazard – low. 10. Physical hazard – moderate.	1. Have fuel spill equipment handy and do not fuel hot equipment. 2. Keep hands and feet from moving parts and from beneath drums. 3. Use of drum lifter to pick up drums. 4. Careful handling of sharp munitions debris fragments.
EQUIPMENT TO BE USED	**INSPECTION REQUIREMENTS**	**TRAINING REQUIREMENTS**
1. Bobcat or backhoe. 2. Drum lifter. 3. Hand Tools 4. Level-D protection. 5. Leather gloves. 6. Safety glasses required if an eye hazard exists. 7. Steel or composite-toed leather boots. 8. Hard hats if applicable.	1. Inspect munitions debris for explosives. 2. Inspect safety devices on heavy equipment. 3. Ensure that drums are properly sealed and drum lifter is properly attached to heavy equipment.	1. Personnel will be properly trained to operate equipment. 2. UXO-trained personnel will supervise this activity. 3. Site-specific safety indoctrination.

Table 13-1. Activity Hazard Analysis (continued)

ACTIVITY: Transport by Boat to Cay Sites

ANALYZED BY/DATE: MGB 4/16/05

PRINCIPAL STEPS	POTENTIAL SAFETY / HEALTH HAZARDS	RECOMMENDED CONTROLS
1. Fueling the boat. 2. Loading and offloading of equipment. 3. Boat operations. 4. Use of docks. 5. Anchoring. 6. Safety support.	1. Fuel spill. 2. Slip, trip, and fall hazards due to wet decks and boat motion. 3. Crash into shallow reefs or bottom. 4. Slippery docks.	1. Have fuel spill equipment handy and do not fuel hot equipment. 2. Keep hands and feet from moving parts. 3. Use of lines to secure access to shore. 4. Keep boat pilot on boat in case of an emergency. 5. Obey buoys and carefully navigate shallow areas. 6. Use docks whenever possible. 7. Do not walk around boat while boat is in motion. 8. Use mooring buoys when available. 9. Do not go out if sea conditions are too rough.
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
1. Boats. 2. Anchors. 3. Life jackets. 4. Marine radios.	1. Inspect propeller before leaving dock. 2. Monitor sea conditions.	1. Boat captain must be trained and certified. 2. Site-specific safety indoctrination.

14.0 References

14.0.01 EEG, 2005. Work Plan – Non-Time-Critical Removal Action at the Municipality of Culebra, Puerto Rico.

14.0.02 US Department of the Army, Accident Reporting and Records, AR 385-40, 01/11/94.

ATTACHMENT A

Site-Specific Health and Safety Plan

SSHSP Acknowledgment

Project: Non-Time-Critical Removal Action
Site: Municipality of Culebra, Puerto Rico
Project Number: 8003
Site Location: Culebra Island & Adjacent Cays
EEG Project Manager / Health and Safety Director: Mark Bagel, PG
Senior UXO Supervisor: Mike Zaloudek

I acknowledge that I understand the requirements of this SSHSP and agree to abide by the procedures and limitations specified. I also acknowledge that I have been given an opportunity to have my questions concerning the SSHSP and its requirements answered prior to performing field activities. Health and safety training and medical surveillance requirements applicable to my field activities at this site are current and will not expire during on-site activities.

Signature	Organization	Date	Social Security No.

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Abbreviations & Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
AR	Army Regulation
bpm	beats per minute
CDC	Centers for Disease Control
CEHNC	United States Army Engineering and Support Center
CIH	certified industrial hygienist
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CWM	chemical warfare materiel
dB(A)	decibels (A-weighted)
DHHS	Department of Health and Human Services
DoD	Department of Defense
DOT	Department of Transportation
EEG	Ellis Environmental Group, LC
EM	Engineer Manual
EOD	explosive ordnance disposal
EP	Engineer Pamphlet
EPA	Environmental Protection Plan
ER	Engineer Regulation
GFCI	ground fault circuit interrupter
HAZWOPER	hazardous waste operations and emergency training
HTRW	hazardous, toxic, and radioactive waste
LEL	lower explosive limit
mA	milliampere
MEC	munitions and explosives of concern
MSDS	material safety data sheet
NEC	National Electrical Code
NESC	National Electrical Safety Code
NIOSH	National Institute of Occupational Safety and Health
OHP	Occupational Health Program
OSHA	Occupational Safety and Health Administration
OT	oral temperature
PPE	personal protective equipment
SOW	Scope of Work
SSHSP	Site-Specific Health and Safety Plan
SUXOS	senior unexploded ordnance supervisor
SZ	support zone
TLV	threshold limit value

TWA	time-weighted average
UL	Underwriters Laboratories, Inc.
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance
UXOQC/SO	unexploded ordnance quality control / safety officer
WBGT	wet bulb globe temperature
WZ	work zone

1.0 Introduction

1.0.01 This Site-Specific Health and Safety Plan (SSHSP) has been prepared by Ellis Environmental Group, LC (EEG) as an attachment to the Accident Prevention Plan (Appendix D of the Work Plan). Both documents are designed to anticipate, identify, evaluate, and control the safety and health hazards that may be encountered during this munitions and explosives of concern (MEC) removal action at the Cerro Balcon area on the Island of Culebra and on Isla Culebrita and additional cays. This SSHSP also describes the response procedures that will be implemented if an emergency arises during the conduct of the site tasks outlined in this document. Where the word "shall" is used, the provisions of the statement are mandatory.

1.0.02 The levels of personal protection and the procedures specified in this plan are based on the best available information from reference documents and current site data. These recommendations represent the minimum safety and health requirements to be observed by all personnel engaged in this project. Unforeseeable site conditions or changes in the Scope of Work (SOW) may warrant a reassessment of protection levels and stated controls. All adjustments to the SSHSP must have prior approval by the United States Army Engineering and Support Center (CEHNC) and EEG.

1.0.03 All EEG personnel involved in this project shall carefully read, understand, and comply with this document, and they should complete the acknowledgement form prior to starting work. All on-site personnel shall follow the designated safety and health procedures, be alert to the hazards associated with working on site, and exercise reasonable caution at all times.

1.0.04 MEC and hazardous waste pose a serious safety and health problem that endangers human and animal life and environmental quality. The regulations and guidelines listed below provide employers and employees with information on the potential for injury and illness resulting from MEC operations.

1.1 Regulations and Guidelines

Following all applicable requirements and regulations listed in the following publications will ensure the safety and health of on-site personnel and the local community:

- Occupational Safety and Health Administration (OSHA) General Industry Standards, 29 Code of Federal Regulations (CFR) 1910
- OSHA Construction Standards, 29 CFR 1926 (United States Army Corps of Engineers [USACE] Engineer Manual [EM] 385-1-1)

- EEG Health and Safety Program
- Army Regulation (AR) 385-40 (with USACE Supplement 1), Accident Reporting and Records
- United States Environmental Protection Agency (EPA) Hazardous Waste Management, 40 CFR 260-276, latest edition
- Engineer Regulation (ER) 385-1-92, Safety and Occupational Health Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities, 01 July 2003
- ER 385-1-95, Safety and Health Requirements for Ordnance and Explosives (OE) Operations, 16 June 2003
- Engineer Pamphlet (EP) 385-1-95a, Basic Safety Concepts and Considerations for Munitions and Explosives of Concern (MEC) Response Action Operations, 27 August 2004

1.2 References

In addition to the publications and regulations previously listed, the following manuals were used as reference material in the preparation of this document.

- Occupational Safety and Health Guidance for Hazardous Waste Site Activities, United States Department of Health and Human Services (DHHS), National Institute of Occupational Safety and Health (NIOSH), October 1985
- Threshold Limit Values (TLV) and Biological Exposure Indices for 1993-94, American Conference of Governmental Industrial Hygienists (ACGIH), 1993

2.0 Safety and Health Organization

2.1 General

2.1.01 All operations and personnel having potential exposure to site hazards are subject to the requirements of this SSHSP. Work may not be performed in a manner that conflicts with the intent of or the inherent safety, health, or environmental precautions expressed in this SSHSP. After due warnings, personnel violating safety procedures will be dismissed from the site.

2.1.02 The safety and health requirements listed in this SSHSP may change as site work progresses; however, no changes will be made without the approval of CEHNC and EEG. The organizational chart for EEG and this project is provided in the Accident Protection Plan.

2.2 Certified Industrial Hygienist

The certified industrial hygienist (CIH), Terry Douglas, is responsible for review and approval of this SSHSP. He is also responsible for providing consultation to the unexploded ordnance (UXO) quality control / safety officer (UXOQC/SO) on safety and health matters and for evaluating and authorizing any changes to the SSHSP.

2.3 UXO Quality Control / Safety Officer

2.3.01 The UXOQC/SO is to be determined. The UXOQC/SO will be a United States citizen and graduate of one of the following schools or courses:

- United States Army Bomb Disposal School, Aberdeen Proving Ground, MD
- United States Naval EOD (Explosive Ordnance Disposal) School
- EOD Assistants Course, Redstone Arsenal, AL; EOD Assistants Course, Eglin Air Force Base, FL; or a Department of Defense (DoD)-certified equivalent course

2.3.02 This individual shall have experience in MEC operations and supervising personnel, and shall have at least 10 years of UXO experience. In addition, this individual shall have the specific training, knowledge, and experience necessary to implement the Accident Prevention Plan and verify compliance with applicable safety and health requirements. This individual must be able to perform all functions enumerated for UXO sweep personnel and UXO Technicians I, II, and III. In addition, the UXOQC/SO must have the ability to implement the approved MEC and explosives safety program in compliance with all DoD, federal, state, and local statutes and codes; analyze MEC and explosives operational risks, hazards, and safety requirements; establish and ensure compliance with all site-specific safety requirements for MEC operations; enforce personnel limits and safety exclusion zones for MEC removal operations, UXO and explosives transportation, storage, and destruction; and conduct safety inspections to ensure compliance with MEC safety codes.

2.4 Responsibilities of All Site Personnel

All EEG and CEHNC personnel who will be involved in on-site activities are responsible for the following:

- Taking all reasonable precautions to prevent injury to site personnel and being alert to potentially harmful situations
- Performing only those tasks that can be done safely and with the proper training provided
- Notifying the UXOQC/SO of any special medical conditions (e.g., allergies, contact lenses, diabetes, etc.)
- Notifying the UXOQC/SO of any prescription and non-prescription medication that a worker may be taking that might cause drowsiness, anxiety, or other unfavorable side effects
- Preventing spillage and splash of materials to the greatest extent possible
- Practicing good housekeeping by keeping the work area neat, clean, and orderly
- Immediately reporting all injuries, no matter how minor, to the EEG UXOQC/SO
- Complying with the SSHSP and all safety and health recommendations and precautions, and properly using the personal protective equipment (PPE) as determined by this SSHSP and/or the EEG UXOQC/SO
- Maintaining current training and medical documentation at the work site

3.0 Site History and Description

3.0.01 Spain ceded all of Puerto Rico to the United States in 1898 following the Spanish American War. The public lands in the Culebra Island archipelago were placed under the control of the United States Navy in 1901. A small permanent base of operations was constructed on Culebra Island around 1902. The base of operations (Lower Camp) was established in the former town of Idelfonso.

3.0.02 The Culebra Island archipelago was used for training purposes by the Navy and the United States Marines, and was later used by North Atlantic Treaty Organization (NATO) gun ships and carriers. Facilities set up by the Navy included a desalination plant, an airfield, barracks, helicopter pads, range instrumentation facilities, gun sites (for the defense of the islands), observation points, and impact ranges for aerial bombs and rockets, missiles, mortars, and naval projectiles.

4.0 Hazard Analysis

4.1 Task Descriptions

4.1.01 The work to be performed under this contract includes MEC surface clearance at the Cerro Balcon area on the Island of Culebra and on Isla Culebrita and additional cays surrounding Culebra. The tasks include:

- Surface clearance of MEC from approximately 30 acres at Cerro Balcon
- Surface clearance of MEC from approximately 82 acres on Isla Culebrita
- Surface clearance of MEC from approximately 39.5 acres on additional cays

4.1.02 Several activities are associated with the work tasks listed above, including:

- Location survey and mapping
- MEC clearance and electromagnetic survey
- Heavy equipment operation, including Bobcat with Bush Hog attachment
- Vegetation clearing using chain saw or bladed trimmer
- Intrusive investigation of partially buried MEC
- Disposal of MEC
- Boat transportation
- Scrap removal

4.1.03 The hazards for these activities are described below.

4.2 Hazard Identification

4.2.1 Preliminary Evaluation

Qualified personnel have performed a preliminary evaluation of the tasks and sites. During development of this SSHSP, a Certification of Activity Hazard Analysis has been completed for each task or group of similar tasks to be conducted under this SSHSP (the hazard analysis forms are included in the Accident Prevention Plan). This assessment has been conducted to comply with the revised OSHA PPE Standard 29 CFR 1910.132 and to ensure that all tasks have been assessed to determine the PPE and controls needed to protect site personnel; however, evaluation of work site characteristics and hazards is an ongoing process that will continue throughout the project. If changes occur in the level or types of hazards present for a currently evaluated task, or if a new task is added to the SOW, the UXOQC/SO will inform the EEG CIH of the change. If needed, a new Certification of Activity Hazard Analysis form will be completed outlining the new hazards, control methods, and PPE for the task.

4.2.2 Chemical Exposure Risk Assessment

In assessing the risk of chemical exposure, EEG personnel examined archival data and sampling results provided by EEG and CEHNC, current land usages, the physical properties of potential site contaminants, the potential exposure routes, and the operational tasks to be performed. Examination of these items indicates that the potential for exposure to chemical hazards will essentially be non-existent during all planned site activities to which this SSHSP applies. If site activities are modified, the potential for chemical exposure will have to be re-evaluated.

4.2.3 Physical Hazards Identification

4.2.3.01 Physical hazards expected to be encountered in conducting operations are heat stress, flammable materials, lifting, operation of hand and power tools, inclement weather, uneven/unstable surfaces, sharp objects (e.g., nails and broken glass), trips and falls, excessive noise, dense vegetation, biological hazards, and heavy equipment.

4.2.3.02 Site personnel should look for potential safety hazards and immediately report the hazards to the EEG UXOQC/SO or the senior UXO supervisor (SUXOS). Site personnel will be informed of the actions to be taken to control or remove the hazard.

4.2.3.03 The EEG UXOQC/SO shall be responsible for thoroughly evaluating each day’s field operations with respect to potential physical hazards. Any suspect or known physical hazards and the specific procedures to control them shall be reviewed and documented during the daily tailgate safety briefing.

4.2.4 MEC Hazards

The hazards associated with MEC include the possibility of personnel injury or death caused by explosion, fire, fragmentation, or over-pressurization. These hazards may result if MEC is not properly located, identified, handled, transported, or disposed of. The risk of personnel exposure to MEC during this project is high, primarily due to the nature and amount of ordnance used on this site. While there is no “safe” procedure for dealing with MEC, using procedures that are considered the least dangerous reduce the exposure. Maximum safety in any MEC operation can be achieved through adherence to applicable safety precautions, a planned investigation, and removal approach coupled to strong intense supervision. For all site operations with the potential for exposure to MEC, only those personnel absolutely essential to the operation shall be allowed in the exclusion zone (restricted area). The safety requirements that are discussed in this work plan have been developed to reduce exposure and will be used throughout this tasking.

4.2.5 Biological Hazards

Biological hazards include stinging insects such as bees, wasps, and hornets; poisonous plants; ticks; mosquitoes; and acacia thorns. Employee awareness and safe work practices will reduce the risk associated with these hazards.

4.3 Hazard Communication

To comply with the OSHA Hazard Communication Standard 29 CFR 1910.1200 and to ensure that site personnel are informed of the hazards associated with the materials with which they work, the following shall apply to all commercial products containing hazardous substances that are brought on site.

- A written hazard communication program will be made available to site personnel.
- A Material Safety Data Sheet (MSDS) will be maintained for each product containing a hazardous substance that is used on site.
- All containers not supplied with adequate hazard labeling shall have a hazard communication label affixed to the container that communicates the health and physical hazards associated with working with the material.
- Employees working with hazardous substances shall be trained in accordance with the requirements of 29 CFR 1910.1200.
- An inventory (MSDS) of all hazardous substances used on site will be maintained in Attachment B of the Accident Prevention Plan.
- Personnel, including subcontractors, affected by hazardous substance use shall be informed of the hazards.
- When available, MSDSs for chemicals known or suspected to be on site will be maintained in the field office. Workers will be advised of the location and contents of these MSDSs in accordance with the requirements of this SSHSP.

5.0 Training Plan

5.1 General

All personnel assigned to or regularly entering the site will have the required training prior to participating in site activities, and documentation of all training is required to be kept on site. In accordance with 29 CFR 1910.120 and other OSHA regulations, applicable training shall include the following.

5.1.1 Basic OSHA Training

All general site workers must have the 40-hour hazardous waste operations and emergency response (HAZWOPER) training course and three days of field experience under the direct supervision of a trained and experienced supervisor. On-site management must have 8 hours of specialized supervisory training. All workers must have an annual refresher (8 hours) if initial training is more than one year old. All training will be documented.

5.1.2 First-Aid and CPR Training

At least two employees per site will be certified in first-aid and cardiopulmonary resuscitation (CPR). The training shall be equivalent to that provided by the American Red Cross.

5.1.3 Site-Specific Safety Indoctrination

This training covers the information and mandates of the project SSHSP. This training stresses preventive measures but also addresses emergency response procedures and will cover the chemical and physical hazards of the site and site operations.

5.1.4 Blood-Transmitted Pathogen Training

The UXOQC/SO will primarily be responsible for rendering first aid in the event of an injury or accident, but other EEG site personnel may be needed to assist in rendering first aid for severe injuries; therefore, on-site EEG personnel will receive training in controlling exposures to blood-transmitted pathogens. This training will consist of the following:

- Labeling and color-coding of infectious waste
- Management and employee responsibilities
- Review of the blood-transmitted pathogen standard
- Description of the risks of exposure and how blood-transmitted pathogens are transmitted
- Hepatitis B Vaccine Declination form (see Appendix F of the Work Plan)

- Requirements of the exposure control plan
- Post-exposure procedures
- Methods of protection against exposure and procedures for decontamination
- First-aid or medical assistant qualified employee and EEG's bloodborne pathogen program (29 CFR 1910.1030, and EM 385-1-1, Section 03.A.06)

5.1.5 Hearing Conservation Training

All site personnel exposed to noise levels exceeding an 8-hour time-weighted average (TWA) of 85 decibels (A-weighted) [85 dB(A)] will be provided with training that addresses the following topics:

- Noise exposure limits
- Physical and psychological effects of high noise exposure
- Elements of the hearing conservation program
- Selection, use, and limitations of hearing protection devices

5.1.6 Fire Extinguisher Training

All EEG site personnel will be trained in the general principles of fire extinguisher selection and use and the hazards associated with incipient-stage firefighting. This training will, when feasible, include hands-on practice with a live test fire.

5.1.7 Tailgate Safety Briefings

5.1.7.01 Each day, before starting work on site, all personnel, including contractor, subcontractor, and government employees, will be given a safety briefing by the EEG UXOQC/SO that identifies potential hazards and risks that may be encountered during that day's activities. Additional training for the use of safety equipment, emergency medical procedures, emergency assistance notification procedures, and accident prevention, as well as discussion of the Work Plan, will ensure that work accomplishments can be carried out in a safe and effective manner. At the conclusion of each day's work, a debriefing for all employees will be held if needed.

5.1.7.02 Records of all tailgate safety briefings documenting date, attendance, and topics covered will be maintained in the EEG Tailgate Safety Briefing/Training Form as part of the project documents.

5.2 Visitor Training

Site visitors are defined as persons who are not employed at the project site and do not routinely enter restricted work areas, and whose presence is of short duration (i.e., one to two days at a time or per month). Visitors may include client personnel, EEG personnel, subcontractor personnel, commercial vendors, political representatives, and auditors or inspectors from local, district, or federal agencies.

5.2.1 General Visitor Requirements

The following requirements apply to visitors whose purpose is to observe site conditions or field activities.

- The senior EEG on-site representative and the EEG UXOQC/SO will be notified of the nature and duration of the visit before visitors are permitted to enter the work site.
- The Visitor Log will be completed, including the individual's name, the date, and the name of the company or agency represented.
- The site visitor will be escorted by an EEG representative, preferably the site supervisor or UXO Technician III, at all times while in the area.
- Visitors will comply with specific safety and health requirements, as applicable.

5.2.2 Visitor Training Requirements

All visitors will receive site-specific training to ensure that potential hazards and risks are identified. This training will consist of a safety briefing by the EEG UXOQC/SO that will include the following:

- Required PPE
- Location and description of potential hazards and risks
- Areas of the site that are closed to visitors
- The site evacuation plan and emergency procedures
- Other topics as deemed appropriate

5.3 Supplemental Training

Supplemental training (e.g., confined space, hazard communications, and OSHA chemical-specific requirements), as determined by the EEG UXOQC/SO, may be required for site-specific contaminants and/or changes in site conditions.

5.4 Weekly Training

At the start of each work week (normally Monday), a site-specific safety topic will be selected and discussed in detail. All site personnel are required to attend the training, and the EEG UXOQC/SO will document this training on the EEG Tailgate Safety Briefing / Training Form. The training will consist of site-specific hazards (e.g., known chemicals, ordnance, and heat stress), and it will be given in conjunction with the tailgate safety briefing.

5.5 Buddy System Training

Workers shall be instructed that all site work will be performed using the buddy system. Team members will keep in visual contact with each other at all times. Team members will be made aware of any slip or trip and all lifting hazards, as well as any potential exposure to chemical substances, cold stress, and general hazards within their work area.

6.0 Personal Protective Equipment Program

6.1 Introduction

6.1.01 All personnel performing operations on site shall be required to use the appropriate level of protection as specified in the Certification of Activity Hazard Analysis forms. This SSHSP makes provisions for the use of Level D and Modified Level D PPE in accordance with the hazards associated with a given task or operation. All PPE requirements for site operations, activities, or zones are based on available site characterization and historical data. The PPE levels will need to be reassessed if any of the following occur:

- Appearance of previously unidentified chemicals or conditions
- Introduction of a new task or expansion of a previously evaluated task
- Ambient weather condition changes that impact the use of assigned PPE
- Discovery and confirmation of chemical warfare materiel (CWM)

6.1.02 For work tasks that are assigned after the approval of this SSHSP, the EEG UXOQC/SO will assess the hazard, assign the appropriate PPE level, complete a Certification of Activity Hazard Analysis form, and forward the form to the EEG CIH. Upon approval by the CIH and CEHNC, the new form will be incorporated into the SSHSP. The EEG CIH will allow any changes in PPE levels involving downgrading of PPE levels only after review.

6.2 Special Considerations

The following special considerations shall be observed in the selection and use of Level D and Modified Level D PPE.

- Hard hats are required only when working around heavy equipment or when a head impact hazard exists.
- Steel toe/shank boots are not required during surface or subsurface location of MEC unless a serious toe hazard exists, whereupon a fiber safety toe will be used.
- Safety glasses will be required only when an eye hazard exists and will be selected to provide site personnel with the best protection from physical hazards, such as flying objects and ultraviolet radiation protection.
- The revised OSHA standards for PPE (29 CFR 1910.132-138) will be incorporated into all phases of PPE selection, training, and use.
- Eye protection will be required during brush clearing.

6.2.1 Level D PPE

The following PPE will be worn during general site zone activities:

- Work clothes or coveralls (cotton)
- Hard hat (as required)
- Boots: fiber-toed or leather work boots (as required)
- Work gloves
- Safety glasses (as required)
- Two-way radio, one per team

6.2.2 Modified Level D PPE

The following PPE will be worn when using power equipment for brush clearing (same as Level D, but with the following additions):

- Leather work gloves
- Hard hat with face shield (wire mesh preferred)
- Kevlar chaps
- Ear plugs or muffs, as appropriate
- Fiber toe guards or fiber-toed boots

7.0 EEG Medical Surveillance Program

EEG provides its employees with an annual in-depth physical examination, including blood chemistry with complete blood count and differential, urinalysis, medical history, required chest X-rays, audiogram, pulmonary function testing, and a physician's interpretation of an employee's ability to wear a respirator.

7.1 EEG Comprehensive Occupational Health Program

7.1.01 EEG has established and will enforce a comprehensive Occupational Health Program (OHP) in compliance with 29 CFR 1910 to prevent, diagnose, and treat occupational illnesses and injuries sustained on site. All site personnel and subcontractors involved with site activities will be included in the OHP.

7.1.02 The purpose of the OHP is to (1) assess the individual's health prior to working in a hazardous or physically stressful environment, (2) determine the individual's suitability for work assignments requiring the use of PPE, and (3) monitor for evidence of changes in the individual's medical indicators that could be related to the work. The assessment addresses any physical conditions the employee could have that would predispose him or her to illness or injury due to chemical exposure or the physical demands of using PPE.

7.1.03 The examining physician will be provided with information related to the employee's duties, potential exposures to chemical and physical hazards, and a description of the levels of PPE to be used by the employee. The physician will conduct a physical examination as specified in this section and then review the examination results to determine whether the employee is medically qualified to perform the proposed hazardous work. The physician will determine the need for any subsequent (i.e., exit or supplemental) medical examinations.

7.1.04 A physician's statement certifying that the employee is physiologically fit to work in hazardous materials operations will be received and maintained on file at EEG prior to the commencement of work. The physician's statement will also include information related to limitations on the employee's work assignment, results of the examination and tests, and a statement that the employee has been informed of the results of the medical examination.

7.2 Certification

EEG employee participation in the medical surveillance program will be a part of the employee's permanent medical record maintained at EEG's Newberry, Florida, office. A list certified by the project manager, including the date of the last examination and physician's name, will be maintained on site. If subcontractors are used, they will also submit documentation of medical surveillance program participation for all site employees.

7.3 Occupational Health Services

Complying with the requirements of 29 CFR 1910, EEG has designated the following physician to oversee the site-specific medical surveillance and occupational health services:

Lance Chodosh, MD
4340 Newberry Road
Gainesville, FL 32607
Telephone (352) 372-3360

7.3.1 Medical Surveillance Examinations

Job-related medical surveillance examinations are baseline, annual, supplemental, and termination examinations. The content of these examinations is hazard-specific and requires EEG to provide the examining physicians with a complete inventory of chemical, biological, and physical exposure hazards, including relevant medical surveillance documents and pertinent information related to the following:

- Hearing conservation
- Treatment of occupational illness and injury
- Vision conservation
- Medical evaluation of respirator wearers.

7.3.1.1 Baseline and Annual Examinations

The baseline and annual assessments will include the following:

- Complete medical and occupational history
- Drug testing
- Chest X-ray (preliminary assessment) and/or electrocardiogram (when determined to be necessary by the physician)
- Laboratory studies, including a complete blood count
- Physical examination
- Urinalysis
- Audiometry and visual screening
- Pulmonary function testing (FEV and FVC)

7.3.1.2 Supplemental Examination

Any worker receiving a potentially harmful level of exposure to hazardous chemical or biological material or who exhibits possible exposure symptoms will undergo a supplemental examination. Any worker who develops a lost-time illness or sustains a lost-time injury will be re-examined. The physician will certify in writing that the employee is fit to return to work. If necessary, activity restrictions will also be specified in writing. Additional tests will be conducted if contaminants or potential exposures dictate, and they will be determined by the examining physician.

7.3.1.3 Termination Examination

Upon termination of employment, personnel who have worked continuously at a hazardous waste project site for more than six months will be given the opportunity to undergo a termination examination equivalent to the baseline examination. The physician will determine specific examination tests.

7.3.2 Immunizations

Personnel working on this site will receive a tetanus immunization prior to beginning work.

7.4 Health Care Administrative Services

In support of the OHP, Dr. Chodosh will establish and maintain medical records. These records will be treated as private and confidential information, and they will be complete enough to provide data for use in health maintenance, treatment, and epidemiologic studies, and to help the government and EEG with program evaluation and improvement. The medical record will contain sufficient information to identify the patient, support the diagnosis, justify the treatment, and document an additional follow-up case or referral. The physician’s written opinion for all medical examinations will be as specified in 29 CFR 1910.120, Subpart (f)(7).

7.5 Medical Support Policies

EEG site personnel will be provided routine occupational health services by Dr. Chodosh at no cost to the employee. The scope of occupational health services provided by EEG shall include efforts to prevent, diagnose, or treat occupational injuries or illness. EEG shall not provide definitive diagnoses or treatments for non-occupational injuries or illnesses. The only exception is an emergency where immediate medical attention is required to prevent the loss of life, preclude permanent injury that would result if treatment were delayed, or relieve suffering.

7.5.1 Operational Concepts

Two appropriately trained personnel will provide on-site first-aid and CPR support. If specialized or elevated care is necessary, the injured person will be transported to the appropriate medical facility by an on-call advanced life-saving service.

7.5.2 Treating Hospitals

The Culebra Community Health Center (telephone 787-742-3511) located at Calle William Font Final will provide primary treatment for illnesses or injuries that occur on site. This clinic has trauma capabilities; however, severe cases will be sent by helicopter to the hospital at San Juan. The Culebra Community Health Center will act as coordinator should a severe trauma occur.

7.5.3 On-Site Medical Supplies

Medical supplies for the treatment of minor injuries and burns will be maintained on site by EEG and will be inspected weekly by the EEG UXOQC/SO.

7.6 Environmental and Personal Monitoring Plan

Monitoring will be conducted during specified site activities to evaluate potential physical hazards. Hazard evaluations will assist in determining the effectiveness of control measures, the need for upgrading or downgrading PPE requirements, and the effectiveness of work zones (WZs) and safe work practices. Direct reading instruments will be used during site operations to detect and qualify the physical hazards. If a reading exceeds the action levels specified in **Table 7-1**, the EEG UXOQC/SO will take steps to correct the situation.

Table 7-1. Site Monitoring Schedule / Action Levels

Contaminant or Hazard	Monitoring Equipment	Monitoring Responsibility	Monitoring Frequency / Location	Action Level	Action to be Taken
Heat stress	Direct reading wet bulb globe temperature (WBGT) monitor	UXOQC/SO	Continuously, whenever ambient temperatures exceed 70°F	See Table 9-4 to determine WBGT temperatures where modification of work/rest regimens will begin	See Table 9-4 for modifications to work/rest regimens
Noise	Sound level meter	UXOQC/SO	Initially when tools or equipment are operated and periodically thereafter, according to the recommendations of the CIH	Sound levels greater than 85 dB(A)	Conduct noise dosimetry reading to determine the 8-hour TWA and advise CIH

Contaminant or Hazard	Monitoring Equipment	Monitoring Responsibility	Monitoring Frequency / Location	Action Level	Action to be Taken
Noise	Noise dosimeter	UXOQC/SO	Whenever noise levels in the hearing zone exceed 85 dB(A)	Greater than 85 dB(A) for an 8-hour TWA	Report dosimeter readings to CIH to ensure that hearing protection is adequate for the level of noise experienced

7.6.1 Monitoring Responsibilities

The EEG UXOQC/SO and other site personnel trained in the proper calibration and operation of monitoring equipment will conduct monitoring on an as-needed basis. Monitoring equipment to be used during operations will include the following, as needed.

- Sound level meter is used as a screening device to measure the sound power being emitted by a source. This instrument helps identify operations where hearing protection and noise dosimetry monitoring may be needed.
- Noise dosimeter is used to calculate the 8-hour TWA noise exposure.
- Wet bulb globe temperature (WBGT) monitor is used to establish work/rest regimens for site personnel working in temperatures over 70 degrees Fahrenheit (°F).

7.6.2 Monitoring Schedules

Exposure monitoring will focus on the potential exposure to noise generated during mobilization and demobilization and brush-clearing activities. Real-time monitoring, using direct reading instruments, will be conducted at a frequency respective to operations with high noise levels. **Table 7-1** identifies the type of monitoring equipment to be used, the frequency at which the monitoring will be conducted, assignment of monitoring responsibility, monitoring method to be employed, action level, and the resultant action to be taken.

7.6.3 Calibration and Maintenance

All monitoring instrumentation used on site will be calibrated and/or response-checked in accordance with the manufacturer’s specifications, before and after use each day. If an instrument fails to calibrate or respond correctly, it will be removed from service until it can be repaired in accordance with the manufacturer’s specifications. Instruments used in the WZ will be cleaned with wet wipes after each day of use to remove any gross amounts of dust or debris.

8.0 Site Control and Layout

8.1 Site Zones

EEG may establish work areas as required for the field effort. The boundaries of each work area, regardless of its configuration, will be clearly identified to prevent accidental intrusion by personnel not immediately involved with site operations. Each work site will have a support zone (SZ) that will be used as a staging area for personnel and equipment supporting operations in the WZ. The SZ will include the site access control point, an area for visitors, and a break area for site workers. The EEG UXOQC/SO will delineate and increase or decrease these zones based on site conditions and activities. The zones will be marked on the site map, and the map will be posted at the entrance to each site. The establishment of access points and an entry corridor will be determined by EEG personnel based on the MEC clearance of certain areas.

8.1.1 Support Zone

The SZ will be used as the staging area for site operations and for other support functions required to maintain smooth operations on site. The SZ includes the change area, lunch and break areas, and supply storage areas. The SZ is the designated area for tobacco product use and eating and drinking.

8.1.2 Work Zone

The WZ will be the area where actual site activities related to the investigation of MEC contamination will be conducted. It is anticipated that multiple WZs will be established during the conduct of this project. Each WZ will be clearly marked with flagging, and the EEG UXOQC/SO will control entry into these areas. Non-UXO-qualified personnel entering the WZ will be limited to cleared areas or escorted by UXO-qualified personnel at all times. The maximum fragmentation distance will determine the WZ boundary.

8.2 Site Maps

Prior to the initiation of site activities, the UXOQC/SO will generate a site map for each WZ that indicates the following information: site size and shape; direction of the prevailing wind; entry and exit points; restricted areas; designated assembly points; location of fire extinguishers and other safety equipment; and location of ponds, streams, pits, tanks, and other site hazards. The UXOQC/SO will use the site map during the tailgate safety briefings to inform site personnel of the locations of the previously listed items. To minimize clutter on the map, overlays can be used to portray the necessary information.

8.3 Center of Operations

The center of operations for the site will be located on Culebra at a location to be determined. Site personnel records and complete site maps will be kept at this location. The maps will detail the location of entry points, WZs, SZs, staging areas, and survey areas.

8.4 MEC Areas

8.4.01 There will be only shallow excavation as this project is scoped for surface clearance only.

8.4.02 EEG shall dispose of any encountered MEC in accordance with the Work Plan. Disposal or venting operations will be conducted at sites or ranges established in the field after receiving CEHNC approval. Once designated, EEG personnel will secure the disposal and venting sites whenever disposal activities are being conducted.

8.5 Site Security

Site security will be maintained during working hours by the UXOQC/SO, who will ensure that the only personnel entering a given WZ are those who are wearing the proper PPE and have been trained and medically cleared to enter the area. The UXOQC/SO will also ensure that all other safety and health precautions are in place prior to entry by site personnel.

8.6 Buddy System

8.6.01 The buddy system is an important element in controlling personnel exposure to site hazards. No site personnel is allowed to work without another qualified worker there to provide assistance if needed. At all times, each buddy should be able to:

- Observe their buddy for signs of chemical or extreme temperature exposure
- Periodically check the integrity of their buddy's protective clothing
- Observe the site area in which they are working for hazards
- Remain within verbal or visual contact with their buddy
- Notify the personnel in the SZ if emergency assistance is needed

8.6.02 Enforcement of the buddy system by the UXOQC/SO will begin at the access control point to the WZ.

8.7 Site Communications

8.7.01 Effective on- and off-site communication is an integral part of site control and will be established prior to initiating site activities. Off-site communication is required to ensure effective communication with management and emergency response personnel. On-site communication will be used to coordinate site operations, maintain site control, pass along safety information such as monitoring results and work/rest periods, and alert site personnel to emergency situations. All site personnel will be familiar with the different methods of on- and off-site communication. The methods of site communication that may be used on this project are:

- Communication off site:
  —Two-way radio
  —Cellular telephone
- Communication on site:
  —Two-way radio
  —Air horn
  —Hand signals

8.7.02 Site personnel will be familiar with the following hand and audible signals.

- Hand gripping throat — "Breathing problem, can't breathe."
- Thumbs up — "OK, I'm all right, I understand."
- Thumbs down — "No, negative."
- Pointing to ear(s) — "Can't hear, don't understand."
- Waving hand(s) over head — "Need assistance now."
- Pointing to eyes then pointing to a person/object — "Watch person/object closely."
- Grab buddy's wrist — "Evacuate site now, no questions."
- One long horn or siren blast — "Evacuate site to assembly point."
- Two short horn/siren blasts — "Condition under control, return to site."

8.8 Hygiene and Sanitation

8.8.1 Personal Hygiene

8.8.1.01 Hygiene facilities will be established on site to ensure that personnel maintain good personal hygiene. These facilities shall include personnel washing areas and toilet facilities for all site personnel. The personnel hygiene facilities will conform to the requirements specified in 29 CFR 1910.120.

8.8.1.02 Personnel are required to wash their hands, face, and other exposed skin areas prior to leaving the site for breaks or lunch. In addition, personnel will be instructed to personally monitor their hand-to-eye and hand-to-mouth contact at all times due to the hazardous nature of the manzanillo plant and other poisonous plant species. Disposable towels, washcloths, liquid soap, or disposable wipes will be provided for personnel.

8.8.2 Routine Equipment Decontamination

Tools and equipment used in the WZ will be kept free of soil and other debris and will be cleaned at the end of each day to ensure that the equipment is maintained in a safe operating condition.

8.8.3 PPE and Decontamination Procedures

Site personnel using PPE (e.g., gloves, safety glasses) will keep the equipment clean and in good working condition.

8.8.4 Sanitation

Site sanitation will be established and maintained in accordance with 29 CFR 1910.120(n).

8.8.5 Potable Water Supply

An adequate supply of potable (drinkable) water shall be provided on site at all times, and it will be supplied in accordance with the following provisions.

- Containers used for potable water shall be capable of being tightly closed, equipped with a tap, and maintained in a sanitary condition.
- A container used for the distribution of drinking water shall be clearly labeled identifying its contents and not used for any other purpose.
- Water shall not be dipped from the container, and the use of a common cup will not be allowed.
- Where single-service cups are provided, separate sanitary containers will be provided for the storage of the unused cups and the disposal of the used cups.

8.8.6 Non-Potable Water

Outlets and storage containers for non-potable water, such as water for firefighting or decontamination, will be clearly labeled to indicate that the water is not suitable for drinking, washing, or cooking. At no time shall there be a cross-connection or open potential between a system furnishing potable water and a system furnishing non-potable water.

8.8.7 Toilet Facilities

Temporary toilet facilities will be located at the site. Chemical, re-circulating, combustion, or flush toilets may be used to fulfill this requirement. Each temporary toilet will be naturally lighted, have ventilation, be lockable from the inside, and be serviced weekly. To ensure sanitary and adequate facilities, EEG will provide toilet facilities in accordance with the recommendations of the supplier, who usually stipulates one toilet for each 10 to 15 site personnel.

8.8.8 Washing Facilities

Hand- and face-washing facilities will be set up in the SZ and used by all personnel exiting the WZ prior to eating, drinking, tobacco use, or other hand-to-face activities. When feasible, washing facilities will consist of hot and cold running water, soap, and drying towels. If this is not feasible, disposable wipes or an equivalent will be provided.

8.8.9 Site Housekeeping

All work areas will be maintained in a clean and neat condition, free of loose debris and scrap. Any materials and equipment not being used will be removed and stored or disposed of accordingly. All work areas will be supplied with a trash receptacle with lid, the contents of which will be emptied daily.

9.0 Emergency Response Plan and Equipment

9.1 Pre-Emergency Planning

9.1.01 The Culebra Community Health Center (telephone 787-742-3511) located at Calle William Font Final on Culebra Island has the capability of being considered a trauma center when a particular doctor is on Culebra Island. The island has an ambulance that responds; the doctor evaluates the situation and requests assistance as needed. At this time the doctor will request air support from Fajardo or may use the local airport for support. In the case of a serious medical emergency, injured personnel will need to be initially transported to the town of Fajardo, Puerto Rico. This emergency response system is normal to Culebra Island and has not been established for CEHNC projects.

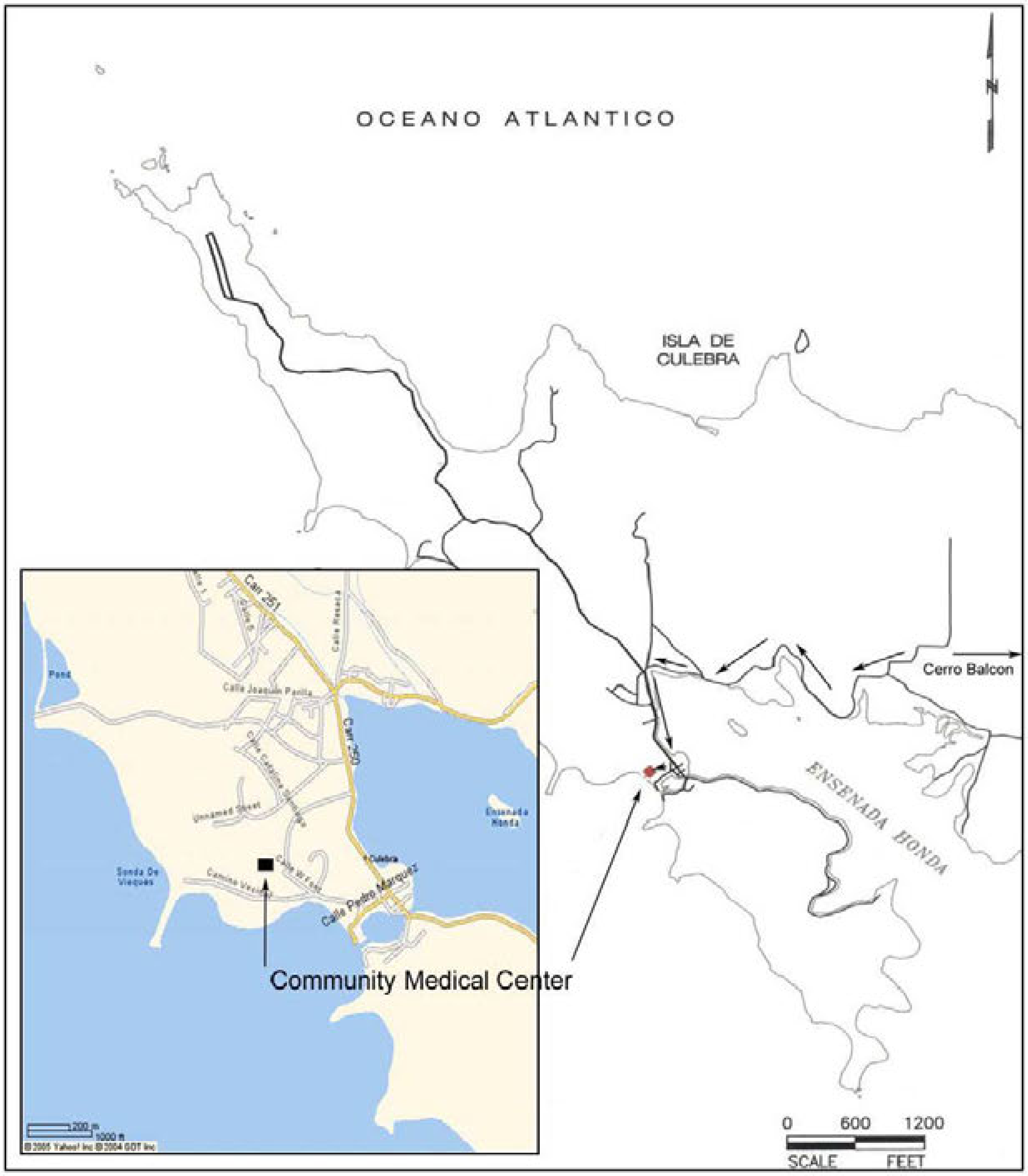
9.1.02 Evacuation, assembly, and site control procedures, the hospital route map (**Figure 9-1**), and emergency numbers will be posted in the office/break area. Hospital route maps shall also be maintained in the designated emergency vehicle, as well as all other site vehicles, and all personnel will be aware of the location of the closest telephone and/or radio communications. To ensure its adequacy, the emergency plan shall be tested prior to commencing site operations. This test shall include a person with a simulated injury who is transported to the supporting medical facility.

9.1.03 The emergency equipment (**Table 9-1**) will be maintained in proper working order and checked daily for completeness during the site work. In addition, a cellular telephone will be located in a support vehicle and verified to be in working order prior to the start of work.

Table 9-1. Emergency Equipment

Item	Number	Location	Operations
Portable Eye Wash Kit	1 (each location)	Support Vehicles / SZ	All
CPR Pocket Mask	1	Support Vehicles / SZ	All
15-min Gravity-Feed Eye Wash	1	Support Vehicles / SZ	All
Air Horn	1	Support Vehicles / SZ	All
First-Aid / Burn Kit	2 (1 each location)	SZ / WZ	All
Fire Extinguisher	1 (each location)	Support Vehicles / WZ	All

Figure 9-1. Hospital Route Map



9.2 First-Aid Kits

The size and number of kits, which include first-aid and eye-wash supplies, a CPR mask, and a burn blanket, will be sufficient to accommodate the maximum number of people (including government personnel and visitors) on site at any given time. The kits will be located at each work site, and the location will be made known to all personnel. Kit locations will be provided with adequate water and other supplies necessary to clean burns, wounds, or lesions.

9.3 Personnel Roles and Lines of Authority

Emergency situations can be minimized through proper implementation of the SSHSP. If an emergency situation develops, the EEG UXOQC/SO will act as the on-scene incident commander. The initial response will be to handle the situation in a calm, deliberate manner so that the situation is controlled and the safety and health of the site workers and surrounding community are not jeopardized. One person designated by the UXOQC/SO will be the off-site coordinator. This person will make all telephone calls to the appropriate emergency response agency. In most cases, this person will be the site manager. The site manager will be responsible for reporting the accident to the on-site contracting officer representative and the EEG project manager.

9.4 Emergency Contacts and Reporting

The list of the emergency phone numbers in **Table 9-2** should be readily available to all employees on the job site. All telephone numbers can be reached via cellular telephone.

Table 9-2. Emergency Telephone Numbers

Agency	Contact	Telephone Number
Police		(787) 742-3501
Fire		(787) 742-3530
Ambulance		(787) 742-3511
Poison Control Center		(809) 962-1253
Culebra clinic		(787) 742-3511
CEHNC project manager	Brendan Slater	(256) 895-1507
USACE Jacksonville	Robert Bridgers	(904) 232-3085
EEG SUXOS	Mike Zaloudek	Obtained upon mobilization
EEG project manager	Mark Bagel	(352) 332-3888
EEG Team 1	Team 1 leader	Obtained upon mobilization
EEG Team 2	Team 2 leader	Obtained upon mobilization

Agency	Contact	Telephone Number
Safety / QC	UXOQC/SO	Obtained upon mobilization
EEG Culebra office		Obtained upon mobilization
EEG Culebra fax		Obtained upon mobilization
EEG site manager	Gary Tourtellotte	Obtained upon mobilization
Federal Aviation Administration (FAA)	Diana Rivera	(809) 253-8694
Coast Guard	Lt. Langum	(809) 729-6800 x227 or x228

9.5 Emergency Procedures

9.5.01 An air horn will be carried by the work team, and one will be kept at the office. One long blast on the air horn will be the signal to immediately evacuate the site. Personnel in the WZ will evacuate to the assembly point specified during the tailgate safety briefing. If the assembly point used by WZ personnel is different from that used by SZ personnel, the EEG UXOQC/SO will use radio communications to coordinate accounting of all site personnel. Once all personnel are accounted for, the EEG UXOQC/SO will outline the actions to be taken as determined by the situation. Two short blasts is the “all clear” signal.

9.5.02 No one will attempt emergency response or rescue until the situation has been assessed and the appropriate response outlined by the EEG UXOQC/SO. Rescue or response may include the following actions, with some actions conducted concurrently.

1. <u>Enforce the buddy system</u>
   Allow no one to enter a contaminated area or hazardous area without a partner. At all times, personnel in the WZ should be in line of sight or within communications contact with the SUXOS or a designated appointee.
2. <u>Survey casualties</u>
   Locate all victims and assess their condition. Determine resources needed for stabilization and transport.
3. <u>Assess hazards</u>
   Assess existing and potential hazards to site personnel and the off-site population. Determine whether or how to respond, the need for evacuation of site personnel and off-site population, and the resources needed for evacuation and response.
4. <u>Request aid</u>
   Contact the required on- or off-site personnel or facilities, such as the ambulance, fire department, police, etc. (see **Table 9-2**).

5. Allocate resources

   Allocate on-site personnel and equipment to rescue and initiate incident response operations.

6. Control

   Assist in bringing the hazardous situation under complete or temporary control and use measures to prevent the spread of the emergency (e.g., cover hole with tarp or plastic or wood, control fire, and secure site).

7. Extricate

   Remove from or help victims leave the area.

8. Stabilize

   Administer any medical procedures that are necessary before the victims can be moved. Stabilize or permanently fix the hazardous condition. Attend to what caused the emergency and anything damaged or endangered by the emergency (e.g., drums and tanks).

9. Transport

   No one will be transported without being decontaminated. Take measures to minimize chemical contamination of the transport vehicle, ambulance, and hospital personnel.

10. Log casualties

    Record who, time, destination, and condition at transport.

11. Track casualties

    Record disposition, condition, and location.

9.5.03 Communication with response services will be conducted by the EEG UXOQC/SO followed by notification to, as events allow, the CEHNC Safety and Occupational Health Office and the CEHNC CIH responsible for the investigation.

9.5.1 Accident / Incident Reporting

In the event of an accident or incident, the EEG UXOQC/SO will be immediately notified. Within 24 hours of any reportable accident (i.e., personal injury, damage to equipment, or physical damage in excess of $2,000), the EEG UXOQC/SO will notify the CEHNC project manager and will complete and submit an accident report on ENG Form 3394, in accordance with AR 385-40 and the USACE supplements to that regulation. A copy of ENG Form 3394 with instructions is included in Appendix F of the Work Plan.

9.5.2 Fires and Explosions

9.5.2.1 Fire Extinguishers

A dry-chemical-type 4A:20B:C fire extinguisher will be available at each individual work site. Dry chemical fire extinguishers will be provided at all other site locations where flammable materials may present a fire risk. A fire extinguisher rated at least 1A:10B:C will be located with each piece of heavy equipment and in each site vehicle.

9.5.2.2 Small Fires

A small fire is defined as a fire that can be extinguished with a type 4A:20B:C fire extinguisher. In the event of a small fire, site personnel will take the following actions.

- Evacuate all unnecessary personnel from the area, preferably to an upwind location.
- Attempt to extinguish the fire using portable fire extinguishers or by smothering it from an upwind location. (**Note:** Do not attempt to extinguish a fire involving explosives or explosive liquids.)
- Request emergency response assistance (i.e., ambulance, fire, and police), as needed, for any injuries or exposures to hazardous chemicals.

9.5.2.3 Large Fires

In the event of a large fire, or small fire that cannot be extinguished, the following actions will be taken.

- Evacuate all unnecessary personnel from the site, preferably to an upwind location.
- Notify the fire department or other emergency response services (i.e., police, fire, ambulance, and hospital), as needed.
- Order the appropriate level of protective clothing to be worn by personnel fighting the fire. Try to fight the fire from an upwind location.
- Do not attempt to extinguish a fire involving explosives.

9.5.2.4 Explosions

In the event of an explosion, all non-essential personnel will evacuate the site, required support equipment and personnel will be requested, and the CEHNC contracting officer or designated representative and the EEG project manager will be notified.

9.5.3 First-Aid Procedures

The following first-aid procedures will be followed when on-site first-aid personnel must render assistance for individuals injured on site.

- For minor injuries, use routine first-aid procedures.
- For major injuries, immediately call an ambulance and administer the appropriate first aid while awaiting arrival of the ambulance.
- Use Red Cross-approved measures for treatment.
- Wash or rinse affected area thoroughly with copious amounts of soap and water, and then provide appropriate medical attention if required.
- If chemicals have been splashed into the eyes, rinse eyes for at least 15 minutes.
- If illness or injury involves the inhalation of hazardous materials, move victim to fresh air and, if necessary, decontaminate and transport to the hospital.
- For any injury or illness involving exposure to hazardous chemicals, decontaminate the victim and transport to the hospital for professional medical attention.
- The EEG UXOQC/SO will provide personnel data sheets to the appropriate medical personnel as requested.

9.5.4 Inclement Weather

9.5.4.01 In the event of inclement weather, electrical storms, or tropical storms, it may be necessary to cease operations and evacuate the site. The EEG UXOQC/SO and the site manager will be responsible for monitoring the weather on a daily basis and advising the SUXOS and the personnel of the forecast. In the event of adverse weather, the EEG UXOQC/SO will determine whether work can continue without sacrificing the safety and health of site personnel. Items to be considered in determining whether work should continue include:

- Heavy rainfall
- Approaching tropical storms
- Limited visibility
- Malfunctioning of monitoring equipment
- Potential for heat stress
- Tornadoes
- Potential for accidents

9.5.4.02 Severe weather with thunderstorms and associated lightning and tornadoes is a common feature of the region; therefore, meteorological conditions will closely be watched. Thunderstorms and tornadoes often occur late in the afternoon on hot days, but they can occur at any time of the day in any season of the year.

9.5.4.03 Tornadoes are usually preceded by severe thunderstorms with frequent lightning, heavy rains, and strong winds. A severe thunderstorm or tornado watch announcement on the radio or television indicates that a severe thunderstorm or tornado is possible. Work will continue at the work site during severe thunderstorm or tornado watches. A severe thunderstorm or tornado warning signifies that a severe thunderstorm or tornado has been sighted or detected by radar and may be approaching. All on-site work will cease during a thunderstorm, severe thunderstorm warning, or tornado warning.

9.5.4.04 Personnel on site during a tornado will take the following steps.

- Evacuate office trailers or vehicles.
- Stay away from power poles, electrical appliances, and metal objects.
- If outdoors, lie flat in a ditch.
- Do not try to outrun a tornado.

9.5.5 Spill Response

Site operations should not involve handling large containers of hazardous waste that could be easily spilled; however, small containers (5 gallons or less) of gasoline, solvent, or diesel fuel may be used and stored on site. If material from these containers is spilled, EEG personnel will follow these steps.

- Evacuate the immediate area and extinguish ignition sources.
- The EEG UXOQC/SO will evaluate the situation to ensure that it is safe for personnel to begin cleanup operations.
- Using non-sparking or appropriately grounded tools, collect the contaminated soil and place it into a plastic bag, which will then be placed into a 55-gallon Department of Transportation (DOT)-approved drum.
- The EEG UXOQC/SO will notify the CEHNC site representative that the spill occurred and await guidance on disposal of the drummed contaminants.

9.5.6 Material Safety Data Sheets

MSDSs include valuable information for the treatment of exposure to chemicals, response to fires, chemical properties, chemical reactivity, toxicity, hazard classifications, and response to discharge. MSDSs will be posted on site for all materials and are included in Attachment B.

9.6 Confined Space Entry

9.6.01 According to 29 CFR 1910.146, a confined space is defined as having all of the following criteria:

- It is not large enough nor configured so that an employee can bodily enter and perform assigned work.
- It is not designed for continuous human occupancy.
- It has limited or restricted means for entry or exit.

9.6.02 Confined space entry is not anticipated as part of the site surface clearance operations; however, if an excavation meets all three of these criteria, it must be defined as a confined space, and the provisions and safety precautions of the EEG SSHSP will apply.

9.7 Spill Containment

In the event of a spill, an absorbent material will be used to contain the spill and absorb the excess liquid. After the excess liquid has been absorbed, the saturated absorbent will be placed in an appropriate sized steel drum for later disposal. Contaminated soil beneath the spill will also be immediately excavated and placed in drums.

9.8 Heat Stress

Heat stress is one of the most common (and potentially serious) illnesses that can affect hazardous waste site workers. The most common cause of heat stress during site activities is the effect that PPE has on the body's natural cooling mechanisms. Impermeable PPE interferes with perspiration evaporation and causes the body to retain metabolic and environmentally induced heat. Individuals will vary in their susceptibility and degree of response to the stress induced by increased body heat. Factors that may predispose a worker to heat stress include lack of physical fitness, lack of acclimatization to hot environments, degree of hydration, level of obesity, current health status (e.g., having an infection, chronic disease, or diarrhea), alcohol or drug use, and the worker's age and sex. For the remainder of this section, reference to liquids will indicate water or an electrolyte replacement solution, not tea, coffee, or soft drinks.

9.8.1 Heat Stress Disorders

9.8.1.1 Heat Rash

Heat rash is caused by continuous exposure to heat and humid air, and it is aggravated by wet, chafing clothes. This condition can decrease a worker's ability to tolerate hot environments.

- Symptoms
  Mild red rash, especially in areas of the body that sweat heavily.
- Treatment
  Decrease amount of time in protective gear and provide powder such as cornstarch or baby powder to help absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes if needed.

9.8.1.2 Heat Cramps

Heat cramps are caused by a perspiration rate that is not balanced by adequate fluid and electrolyte intake. Heat-related cramps are often an indication that excessive water and electrolyte loss has occurred, which can further develop into heat exhaustion or heat stroke.

- Symptoms
  Acute painful spasms of voluntary muscles such as the back, abdomen, and extremities.
- Treatment
  Remove victim to a cool area and loosen restrictive clothing. Stretch and massage affected muscles to increase blood flow to the area. Have victim drink 1 to 2 cups of liquids immediately and every 20 minutes thereafter. If available, an electrolyte replacement solution should be taken along with water. Soft drinks are inadequate and may aggravate the condition. Consult a physician if condition does not improve.

9.8.1.3 Heat Exhaustion

Heat exhaustion is a state of definite weakness or exhaustion caused by excessive fluid loss from the body. This condition leads to inadequate blood supply and cardiac insufficiency. Heat exhaustion is less dangerous than heat stroke but nonetheless must be treated. If allowed to go untreated, heat exhaustion can quickly develop into heat stroke.

- Symptoms
  Pale or flushed, clammy, moist skin, profuse perspiration, and extreme weakness. Body temperature is basically normal or slightly elevated, the pulse is weak and rapid, and breathing is shallow. The individual may have a headache and be dizzy or nauseated.

- Treatment

  Remove the individual to a cool, air-conditioned place, loosen clothing, elevate feet 8 to 12 inches, and allow individual to rest. Consult physician, especially in severe cases. Fan the individual and apply cool, wet cloths or rubbing alcohol. Give sips of cool water, half a glass every 15 minutes for one hour. The individual should do no work for several days.

9.8.1.4 Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the heat-regulating mechanisms of the body. Failure of the individual's temperature control mechanism causes the perspiration system to stop working correctly. When this occurs, the body core temperature rises rapidly to a point (105+°F) where brain damage and death will result if the person is not cooled quickly.

- Symptoms

  The individual's skin is hot and may or may not be red and dry because the individual may still be wet from perspiration while wearing protective clothing earlier. Symptoms include nausea, dizziness, confusion, extremely high body temperature, rapid respiratory and pulse rates, delirium, convulsions, unconsciousness, or coma.

- Treatment

  Immediately cool the individual. If the body temperature is not lowered, place the individual in cool water to reduce the core temperature to a safe level (less than 102°F). If the individual is conscious, provide cool liquids to drink, but not caffeine or alcoholic beverages. Observe the individual and obtain immediate medical help.

9.8.2 Preventive Heat Stress Measures

To avoid heat-related illnesses, proper preventive measures will be implemented whenever environmental conditions dictate the need.

9.8.2.1 Minimal Preventive Measures

The following minimal steps will be taken.

- The UXOQC/SO will examine each site worker prior to the start of daily operations to determine the individual's susceptibility to heat stress. The UXOQC/SO will closely monitor workers exhibiting factors that make them susceptible to heat stress.
- Site workers will be trained to recognize and treat heat-related illnesses. This training will include the signs, symptoms, and treatment of heat stress disorders.

- Workers will be encouraged to drink a minimum of 16 ounces of liquids prior to start of work in the morning, after lunch, and prior to leaving the site at the conclusion of the day's activities. Disposable cups and liquids will be provided on site. Acceptable liquids will include water and an electrolyte replacement solution, with the intake of each being equally divided. Liquids containing caffeine should be avoided.
- When ambient conditions and site work load requirements dictate, as determined by the UXOQC/SO, workers will be required to drink a minimum of 16 to 32 ounces of liquids during each rest cycle.
- Personnel conducting site clearance operations will be provided camel-paks.
- A shelter or shaded area will be provided where workers may be protected from direct sunlight during rest periods.
- Monitoring of ambient or physiological heat stress indices will be conducted to allow prevention and/or early detection of heat-induced stress.
- Site workers will be given time to acclimatize to working in hot environments. Acclimatization usually takes 2 to 6 days and allows the worker's body to become adjusted to working in hot environments. This process involves a gradual increase of the workload over the 2-to-6-day period. The recommended acclimatization schedule suggests starting workers at 50 percent of the anticipated workload and increasing each day by 10 percent. For fit or trained individuals, the acclimatization period may be shortened to 2 or 3 days.

9.8.2.2 Additional Preventive Measures

When possible and/or feasible, the following measures will also be implemented to prevent or reduce the effects of heat-induced stress.

- Designated rest areas should be air-conditioned and the temperature maintained between 72°F and 76°F.
- Cooling devices will be provided to aid in body heat exchange. Cooling devices may include cooling jackets, vests, or suits and field showers or hose-down areas. Depending on the severity of the heat exposure, some form of artificial cooling may be required to ensure protection of the workers.
- Workers will be encouraged to achieve and maintain an optimum level of physical fitness. Increased physical fitness will allow workers to better tolerate and respond to hot environments and heavy workloads. In comparison to an unfit person, a fit person will

have less physiological strain, a lower heart rate and body temperature, and a more efficient sweating mechanism.

9.8.3 Physiological Heat Stress Monitoring

When site personnel are engaged in site activities involving the use of semi-permeable or impermeable clothing in ambient temperatures greater than 70°F, physiological monitoring will be conducted. The goal of all heat stress monitoring is to ensure that the worker's body temperature does not exceed 100.4°F. The following physiological monitoring methods are to be implemented based on the severity of the heat and workload. At minimum, the UXOQC/SO will monitor the worker's heart rate as an indication of potential heat stress; however, if monitoring with the heart rate method indicates the need for closer, more direct monitoring, the oral temperature method will be implemented. The UXOQC/SO will determine the need for monitoring body water loss based on the observation of sweat loss experienced by site personnel during their work cycle. The frequency of physiological monitoring will be determined using the information presented in **Table 9-3**.

Table 9-3. Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers

Adjusted Temperature[a]	Normal Work Ensemble[b]	Impermeable Ensemble
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5–90°F (30.8–32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5–87.5°F (28.1–30.8°C)	After each 90 minutes of work	After each 60 minutes of work
77.5–82.5°F (25.3–28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5–77.5°F (22.5–25.3°C)	After each 150 minutes of work	After each 120 minutes of work

For work levels of 250 kilocalories per hour

a = Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate % sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow (e.g., 100% sunshine = no cloud cover and a sharp, distinct shadow; 0% sunshine = no shadows). Use decimal expression of percent sunshine.

b = A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Source: NIOSH/OSHA/US Coast Guard (USCG)/EPA. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities. DHHS (NIOSH) 85-115. Cincinnati, OH.

9.8.3.1 Heart Rate Monitoring

The worker's baseline heart rate should be recorded prior to starting site activities by measuring the radial (wrist) pulse rate for 30 seconds. After each work cycle, the heart rate should be measured by taking the pulse rate as early as possible into the resting period. Taking the radial pulse rate is the preferred method; however, the carotid (neck) pulse rate may be taken if a worker has difficulty finding the radial pulse. The pulse rate at the beginning of the rest period should not exceed 110 beats per minute (bpm). If the pulse rate is higher than 110 bpm, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate exceeds 110 bpm at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. This procedure is continued until the pulse rate at the beginning of the rest cycle is maintained below 110 bpm.

9.8.3.2 Oral Temperature Monitoring

If deemed necessary by the UXOQC/SO, and the conditions warrant, oral temperature (OT) monitoring will be conducted. Prior to starting site activities, the worker's OT will be taken with a clinical thermometer placed under the tongue and recorded. The OT must be taken prior to the consumption of cool liquids and will be done at the end of each work period or at a frequency determined by **Table 9-3**. Whenever the OT exceeds 99.6°F, the work cycle must be shortened by one third without changing the length of the rest period. If a worker's OT has exceeded 99.6°F, the OT should be tested again at the end of the rest cycle, and the worker should not be allowed to return to work until the OT drops below 99.6°F. If a worker's OT exceeds 100.4°F, the worker will not be allowed to work in impermeable or semi-permeable PPE for the remainder of that work day.

9.8.3.3 Body Weight Loss

If expected site conditions and work requirements have the potential for causing excessive fluid loss, the UXOQC/SO will monitor workers' fluid loss by weighing each worker prior to and again at the conclusion of each day's site activities. This will be needed to ensure that proper hydration is being maintained and that the total amount of water weight loss throughout the day does not exceed 1.5 percent of the employee's body weight. Body weights will be taken with the workers wearing undergarments only. If, as determined by the UXOQC/SO, site conditions and work requirements cause an extreme amount of fluid loss, body weights will also be taken prior to lunch break. Calculating the water weight loss and assessing the effectiveness of hydration shall be conducted as follows.

1. Subtract the ending weight (W_{ending}) from the daily starting weight (W_{start}) to obtain the weight lost (W_{lost}) during a given work period [i.e., $(W_{start}) - (W_{ending}) = (W_{lost})$].
2. Multiply the starting weight by 1.5 percent to obtain permissible weight loss (W_{perm}) [i.e., $(W_{start}) \times 0.015 = (W_{perm})$].

3. Compare (W_{lost}) to the (W_{perm}). If (W_{lost}) is less than or equal to (W_{perm}), then hydration has been adequate, but if (W_{lost}) is greater than (W_{perm}), then hydration should be increased during the next work period.

9.8.3.4 Wet Bulb Globe Temperature Monitoring

For site conditions where personnel are working in Level D PPE and the ambient temperature is greater than 75°F, the UXOQC/SO will conduct WBGT monitoring to help control the potential for site workers experiencing heat-related adverse health affects. The UXOQC/SO will use a real-time direct-reading WBGT monitor and, after estimating the workload, use the threshold limit values (TLVs) expressed in **Table 9-4** to determine the work/rest schedule to be implemented (a TLV reflects the level of exposure that the typical worker can experience without an unreasonable risk of disease or injury). The values in **Table 9-4** are designed such that nearly all acclimatized and fully clothed workers with adequate salt and water intake will be able to function without the body temperature exceeding 100.4°F. If conditions and/or workloads warrant, the UXOQC/SO may also implement the OT and water-weight-loss monitoring outlined above.

Table 9-4. Permissible WBGT Heat Exposure Threshold Limit Values

Work / Rest Regimen	Work Load*		
	Light	Moderate	Heavy
Continuous work	86°F (30.0°C)	80°F (26.7°C)	77°F (25.0°C)
75% work, 25% rest each hour	87°F (30.6°C)	82°F (28.0°C)	78°F (25.5°C)
50% work, 50% rest each hour	89°F (31.4°C)	85°F (29.4°C)	82°F (27.9°C)
25% work, 75% rest each hour	90°F (32.2°C)	88°F (31.1°C)	86°F (30.0°C)

*Consult the ACGIH TLV booklet for definitions of light, moderate, and heavy workloads.

Values are given in °F and °C WBGT, and are intended for workers wearing single-layer summer-type clothing. Use of semi- or totally impermeable clothing requires monitoring (see 9.8.3, Physiological Heat Stress Monitoring). As work load increases, the heat stress impact on an un-acclimatized worker is exacerbated. For un-acclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5°C.

Source: ACGIH 1993-1994 TLV and Biological Exposure Indices, Cincinnati, OH.

9.8.4 Heat Stress Documentation

The UXOQC/SO will be responsible for recording all heat stress-related information. This will include training sessions and WBGT and physiological monitoring data, and will be recorded on the Wet Bulb Globe Temperature Log and Heat Stress Monitoring Log.

10.0 Standard Operating Procedures and Safe Work Practices

10.0.01 This paragraph outlines the site standing orders that site personnel will obey at all times. The safe work practices address the safety and health precautions related to specific hazards that may be encountered during site operations. Using common sense and following safe work practices can reduce hazards encountered during normal site activities. The following practices are not allowed:

- Running and horseplay
- Smoking, eating, or chewing tobacco while in the WZ or any potentially contaminated area
- Igniting flammable materials in the WZ (equipment will be bonded, grounded, and explosion-resistant, as appropriate)
- Performing tasks in the restricted area individually (i.e., working alone); personnel will be required to work using the buddy system at all times

10.0.02 Personnel must keep the following guidelines in mind when conducting field activities.

- Hazard assessment is a continuous process. Personnel must constantly be aware of their surroundings and the chemical and physical hazards that are or may be present.
- Team members will be familiar with the physical characteristics of each site, including site access and the location of communication devices and safety equipment.
- The location of overhead power lines and underground utilities must be established.

10.1 Heavy Equipment Operation

Heavy equipment used on site will be operated under strict adherence to the applicable OSHA regulations found in 29 CFR 1910 and 29 CFR 1926 and the following guidelines.

- The operation of heavy equipment will be limited to authorized personnel specifically trained in its operation.
- The operator will visually inspect heavy equipment daily prior to operation and report any abnormalities or deficiencies to the UXOQC/SO.
- The operator will use the safety devices provided with the equipment, including seat belts, backup warning indicators, and horns, which will be operable at all times.
- While heavy equipment is in operation, all personnel not directly required to be in the area will keep a safe distance from the equipment.

- The operator's cab will be kept free of all non-essential items, and all loose items will be secured.
- Personnel will avoid moving into the path of operating equipment and areas blinded from the operator's vision.
- When heavy equipment must negotiate tight quarters, or if the operator of earth-moving equipment cannot see the bucket, a second person will be stationed to guide the operator.
- Additional riders will not be allowed on equipment unless it is specifically designed for that purpose (i.e., there is an additional seat with a seat belt).
- Personnel operating heavy equipment will use hearing protection.
- The unit or equipment will be shut down before refueling.

10.2 Power Tools

Power tools have great capability for inflicting serious injury if they are not properly used and maintained. To control the hazards associated with power tool operation, the following safe work practices shall be observed when using power tools.

- Authorized personnel familiar with the tool, its operation, and safety precautions will conduct operation.
- Power tools will be inspected prior to use, and defective equipment will be removed from service until repaired.
- Power tools designed to accommodate guards will have such guards properly in place prior to their use.
- Loose-fitting clothing or long hair will not be permitted around moving parts.
- Hands, feet, etc. will be kept away from all moving parts.
- The power will be disconnected prior to maintenance and/or adjustments to the equipment.
- An adequate operating area will be provided, allowing sufficient clearance and access for operation.
- Electrical tools will be operated in accordance with the applicable specifications.
- Good housekeeping practices will be followed at all times.

10.3 Hand Tools

Use of improper or defective tools can significantly contribute to on-site accidents. The following safe work practices shall be observed when using hand tools.

- Inspect hand tools for defects prior to each use.
- Remove defective hand tools from service and repair or properly discard them.
- Select and use tools in the manner for which they were designed.
- Be sure of safe footing and grip before using any tool.
- Do not use tools that have split handles, mushroom heads, worn jaws, or other defects.
- Wear gloves whenever they increase gripping ability, or if cut, laceration, or puncture hazards may exist during the use of hand tools.
- Wear safety glasses or a face shield if use of tools presents an eye or face hazard.
- Do not use makeshift tools or other improper tools.
- When working overhead, secure tools to ensure that they cannot fall on someone below.
- Use non-sparking tools in the presence of explosive vapors, gases, or residue.
- If hand tools become contaminated, properly decontaminate, bag, mark, and hold the tools for disposition.

10.4 Excavations and Confined Spaces

Not applicable

10.5 Material Lifting

10.5.1 General Requirements

Care should be taken in lifting and handling heavy or bulky items because they are the cause of many joint and back injuries. If needed, EEG will provide back support devices to aid in preventing back injury during lifting activities. The following fundamentals address the proper lifting of materials to avoid joint and back injuries.

- The size, shape, and weight of the object to be lifted must be considered. Site personnel will not lift more than they can comfortably handle. Individual workers should not normally lift loads in excess of 40 pounds.
- A firm grip on the object is essential; therefore, the hands and object shall be free of oil, grease, and water, which might prevent a firm grip.
- The hands and fingers shall be kept away from any points that cause them to be pinched or crushed, especially when setting down the object.
- The item shall be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces, and pinch points, and gloves shall be used, if necessary, to protect the hands.
- The feet shall be placed far enough apart for good balance and stability.

- Personnel will ensure that solid footing is available prior to lifting the object.
- To lift the object, the individual shall bend the legs at the knees and get as close to the load as possible, making sure that the back is kept as straight as possible; the legs are then straightened from their bent position.
- To place the object down, the stance and position are identical to that for lifting, with the back kept straight and the legs bent at the knees.
- Personnel shall not carry a load that cannot be seen over or around.

10.5.2 Two-Person Lifting

When two or more people are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each person, if possible, shall face the direction in which the object is being carried.

10.6 Electrical Hazards

Electrical wiring and apparatus safety procedures will be conducted in accordance with OSHA Standard 29 CFR 1910.137(2). These requirements include but are not limited to the following.

- All electrical wiring and equipment will be of a type listed by Underwriters Laboratories, Inc. (UL) or Factory Mutual Engineering Corp (FMEC) for the specific application.
- All installations will comply with National Electrical Safety Code (NESC) or National Electric Code (NEC) regulations.
- Personnel familiar with and qualified for the class of work to be performed will accomplish all work.
- Live parts of wiring or equipment will be guarded to protect all individuals or objects from harm.
- Electrical wire or flexible cord passing through work areas will be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, or pinching.
- Temporary power lines, switch boxes, receptacle boxes, metal cabinets, and enclosures around equipment will be marked to indicate the maximum operating voltage.
- Patched, oil-soaked, worn, or frayed electrical cords or cables will not be used.
- Portable hand lamps will be of the molded composition type or other type approved for the purpose, and hand lamps will be equipped with a handle and a substantial guard over the bulb that is attached to the lamp holder or the handle.

- Extension cords or cables will not be fastened with staples, hung from nails, or suspended by wire.
- All electrical circuits will be grounded in accordance with NEC and NESC standards unless otherwise noted in the reference manuals.
- A multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle will ground portable and semi-portable electric tools and equipment.
- Semi-portable equipment, floodlights, and work lights will be grounded, and the protective ground will be maintained during moving, unless supply circuits are de-energized.
- Tools protected by an approved system of double insulation or its equivalent need not be grounded.
- UL-listed ground-fault circuit interrupters (GFCIs), calibrated to trip within the threshold values of 5 milliamperes (mA) ±1 mA, are required on all circuits used for portable electric tools.
- In instances where the GFCI is sensitive to equipment vibration, the UXOQC/SO will ensure proper equipment grounding prior to the equipment being used.
- Flexible cord sets will be UL-listed, contain the number of conductors required for the service plus an equipment ground wire, and classified as hard usage or extra hard usage (identified by "outdoor" or "WA" printed on the jacket).
- Bulbs attached to festoon lighting strings will be protected by wire guards or equivalent unless deeply recessed in a reflector.
- Temporary wiring will be guarded, buried, or isolated by elevation to prevent accidental contact by workers or equipment.

10.7 Ladders

Accidents and injuries associated with ladders are frequent and usually severe in nature; therefore, the following safe work practices, along with any of the specialized requirements listed in 29 CFR 1926.1053(b), will be followed whenever ladders are used on site. The UXOQC/SO will be responsible for identifying and communicating any additional requirements related to ladder use during a given task.

- In accordance with 29 CFR 1926.1060, personnel using ladders shall receive training by the UXOQC/SO in the safe inspection, erection, use, and maintenance of the ladders to be used on site.

- Manufactured ladders will be constructed of heavy-duty-grade material, and they will be American National Standards Institute (ANSI)-approved.
- Ladders will be inspected prior to each use by the UXOQC/SO to ensure safe working condition, and defective ladders will be removed from service.
- The area around the top and bottom of a ladder will be kept clear of obstructions and debris.
- Ladders will not be spliced together to make a longer ladder.
- Straight ladders for egress will extend at least 3 feet above the landing and will be secured.
- The base of a straight ladder will be set back from the vertical surface a distance of approximately one-fourth the working height of the ladder.
- A stepladder will be fully opened to permit the spreader to lock, and it will not be closed or leaned against an object for access.
- Metal ladders will not be used for electrical work or in areas where they could contact energized wiring.
- Ladders will be maintained free of grease, oil, or other slipping hazards.
- Job-made ladders will be constructed and used in accordance with OSHA 1926.1053.

10.8 Fire Hazards

Although fires and explosions may arise spontaneously, they are more commonly the result of carelessness during site activities such as moving drums and mixing or bulking of site chemicals, and during the refueling of heavy or hand-held equipment. Some potential causes of explosions and fires include:

- Mixing of incompatible chemicals that cause reactions that spontaneously ignite due to the production of flammable vapors and heat
- Ignition of explosive or flammable chemical gases or vapors by external ignition sources
- Ignition of materials due to oxygen enrichment
- Agitation of shock or friction-sensitive compounds
- Sudden release of materials under pressure

10.8.1 Fire Prevention

Explosions and fires not only pose the obvious hazards of intense heat, open flames, smoke, and flying objects but they may also cause the release of toxic chemicals into the environment. Such releases can threaten personnel on site and members of the general public living or working nearby. The following guidelines to prevent fires and explosions apply to site personnel involved with potentially flammable materials or operations.

- Potentially explosive or flammable atmospheres involving gases or vapors will be monitored using a combustible gas indicator.
- Entry will not be made into any confined space in which the lower explosive limit (LEL) is found to be greater than 20 percent or when the oxygen content is less than 21 percent.
- Prior to initiation of site activities involving explosive or flammable materials, all potential ignition sources will be removed or extinguished.
- Non-sparking and explosion-proof equipment will be used whenever the potential exists for ignition of flammable or explosive gases, vapors, or liquids.
- Dilution or induced ventilation may be used to decrease the airborne concentration of explosive or flammable atmospheres.
- Smoking will be prohibited at or in the vicinity of operations that may present a fire hazard, and the area will be conspicuously posted with signs stating "No Smoking or Open Flame Within 50 Feet."
- Flammable and/or combustible liquids must be handled only in approved and properly labeled metal safety cans equipped with flash arresters and self-closing lids.
- Transfer of flammable liquids from one metal container to another will be made only when the containers are electrically interconnected (bonded).
- Motors of equipment being fueled will be shut off during the fueling.
- Metal drums used for storing flammable or combustible liquids will be equipped with self-closing safety faucets, vent bung fittings, grounding cables, and drip pans, and they will be stored outside of buildings in an area approved by the UXOQC/SO.

10.8.2 Fire Protection

The following safe work practices will be used to protect the site and site personnel against the hazards of fires.

- Flammable or combustible liquid storage areas will have at least one 4A:20:B:C: fire extinguisher located within 25 to 75 feet.
- All earth-moving equipment (e.g., backhoes, bulldozers, and drill rigs) will be equipped with a fire extinguisher of not less than 10:B units or higher.

- All vehicles used in the transport of explosives will be equipped with two fire extinguishers of not less than 10:B units or higher, with one fire extinguisher mounted or placed inside the cab of the vehicle and one mounted outside by the driver's side door, if possible.
- Temporary offices will be equipped with a fire extinguisher of not less than 10:B units or higher.
- At least one portable fire extinguisher having a rating of not less than 20:B units will be located at each work site.

10.9 Biological Hazards

Biological hazards usually found on site include hazardous plants, stinging and biting insects, and snakes, ticks, and spiders. Employee awareness of the following safe work practices should reduce the risk associated with these hazards.

10.9.1 Hazardous Plants

A large number and variety of hazardous plants may be encountered during site activities. The ailments associated with these plants range from mild hay fever and contact dermatitis to carcinogenic affects; however, the plants that present the greatest degree of risk (i.e., potential for contact versus affect produced) to site personnel are those that produce skin reactions and skin and tissue injury.

10.9.1.1 Plants Causing Skin and Tissue Injury

Contact with splinters, thorns, and sharp leaf edges is of special concern to site personnel, as is the contact with the pointed surfaces found on branches, limbs, and small trunks left by site clearing and grubbing crews. Acacia thorns may be particularly prevalent on sites such as Cerro Balcon. This concern stems from the fact that punctures, cuts, and minor scrapes caused by accidental contact may result in non-infectious skin lesions, and fungi or bacteria may be introduced through the skin or eye. This is especially important because the warm, moist environment created inside impermeable protective clothing is ideal for the propagation of fungal and bacterial infection. Personnel receiving any of these injuries, even minor scrapes, should immediately report to the UXOQC/SO for initial and continued observation and care of the injury.

10.9.1.2 Plants Causing Skin Reactions

10.9.1.2.01 Poisonous plants such as manzanillo may be encountered at this site. The manzanillo is a tree growing to a height of 40 to 50 feet, mostly on sandy seashores, said to be so poisonous that men die under the shade of it. It has shiny green leaves with stalked elliptical edges that cut like saw teeth, a single gland on the upper side where the stalk and leaf join, and very small inconspicuous flowers (of separate sexes) on long slender spikes, the few females placed singly at base of the spike with a three-parted calyx, the males in little clusters on the upper part with a two-parted calyx and two or four stamens joined by their filaments, the females with a many-celled ovary crowned with from four to eight styles and re-flexed stigmas. The fruit is a rounded fleshy yellow-green berry. The hazardous components of the manzanillo are the milky, very acrid juice in both the bark and the berries.

10.9.1.2.02 The skin reaction associated with contacting these plants is caused by the body's allergic reaction to toxins contained in oils produced by the plant. Contamination can be achieved through contact with the leaves, branches, stems, or berries, or contact with contaminated items such as tools and clothing. The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact
- Reddening, swelling, itching and burning at the site of contact
- Pain, if the reaction is severe
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin

10.9.1.3 Preventive Measures

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify, report, and mark poisonous plants found on site.
- Wash hands, face, or other exposed areas at the beginning of each break period and at the end of each workday.
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment, and clothing.
- Try barrier creams, detoxification or wash solutions, and orally administered desensitization to find the best preventive solution.

10.9.2 Snakes

10.9.2.01 No poisonous snakes are anticipated on Culebra or surrounding cays; however, snake bites should be treated by a physician to prevent infection and complications.

10.9.2.02 When site activities are conducted in warm weather in wooded, grassy, or rocky environments, the potential for contact with poisonous snakes becomes a real danger. The noise created by a person approaching a snake is usually sufficient to frighten off the snake; however, during the warm months, extreme caution must be exercised when conducting site operations around areas where snakes might be found (i.e., rocks, bushes, logs, or in holes, crevices, and abandoned pipes). If poisonous snakes are identified on site, EEG will issue protective clothing such as snake leggings to site personnel.

10.9.2.03 The following rules apply to snake bites.

- Do not cut “Xs” over the bite area because this will intensify the effect of the venom.
- Do not apply suction to the wound, since this has a minimal effective in removing venom.
- Do not apply a tourniquet, since this will concentrate the venom and increase the amount of tissue damage in the immediate area.
- If possible, kill the snake, bag it, and transport it with the victim, or try to get a good look at it so it can be identified for the proper selection of anti-venom.
- Do not allow the victim to run for help, since running increases the heart rate and will increase the spread of the venom throughout the body.
- Keep the victim calm and immobile.
- Have the victim hold the affected extremity lower than the body while waiting for medical assistance.
- Immediately transport the victim to medical attention.

10.9.3 Ticks

10.9.3.01 The Centers for Disease Control (CDC) has noted the increase of lyme disease and Rocky Mountain spotted fever, which are caused by bites from infected ticks that live in and near wooded areas, tall grass, and brush. Ticks are small, ranging in size to about 0.25 inch. They are sometimes difficult to see; when embedded in the skin, a tick may look like a freckle. The tick season extends from spring through summer.

10.9.3.02 Lyme disease has occurred in 43 states, with the heaviest concentrations in the northeast (Connecticut, Massachusetts, New Jersey, New York, Pennsylvania), the upper midwest (Minnesota and Wisconsin), and along the Northern California coast. It is caused by deer ticks and lone star ticks that have become infected with spirochetes. Female deer ticks are about 0.25 inches in size and are black and brick red in color. Male deer ticks are smaller and completely black. Lone star ticks are larger and chestnut brown in color.

10.9.3.03 Rocky Mountain spotted fever has occurred in 36 states, with the heaviest concentrations in Oklahoma, North Carolina, South Carolina, and Virginia. It is caused by Rocky Mountain wood ticks and dog ticks that have become infected with rickettsia. Both are black in color.

10.9.3.04 The first symptoms of either disease are flu-like chills, fever, headache, dizziness, fatigue, stiff neck, and bone pain. If immediately treated by a physician, most individuals fully recover in a short period of time. If not treated, more serious symptoms can occur. If a team member believes that a tick has bitten him or exhibits any of the signs and symptoms, the team member should contact the UXOQC/SO, who will then authorize a visit to a physician for an examination and possible treatment.

10.9.3.1 Protective Measures

Standard field gear (i.e., work boots, socks, and light-colored coveralls) provides good protection against tick bites, particularly if the joints are taped; however, even when wearing field gear, the following precautions should be taken when working in areas that might be infested with ticks.

- Spray outer clothing, particularly pant legs and socks, **BUT NOT YOUR SKIN**, with an insect repellant that contains permethrin or permanone. Allow the permethrin to dry before using the treated clothing. Apply vapor-active repellant containing DEET (N,n-diethyl-m-toluamide) to any exposed skin surface (except eyes and lips).
- In the field, check often for ticks, particularly on lower legs and areas covered with hair.
- In wooded areas, avoid contact with bushes, tall grass, or brush as much as possible.
- If you find a tick, remove it by pulling on it gently with tweezers.
- If the tick resists, cover the tick with salad oil for about 15 minutes to asphyxiate it, then remove it with tweezers.
- Do not use matches, a lit cigarette, nail polish, or any other type of chemical to coax the tick out.

- Remove all parts of the tick's body and disinfect the area with alcohol or a similar antiseptic after its removal.
- For several days to several weeks after removal of the tick, look for signs of the onset of lyme disease, such as a rash that looks like a bull's-eye or an expanding red circle surrounding a light area, frequently seen with a small welt in the center.
- Also look for the signs of the onset of Rocky Mountain spotted fever, such as an inflammation that is visible in the form of a rash comprising many red spots under the skin, which appears 3 to 10 days after the tick bite.

10.9.4 Bees, Hornets, and Wasps

10.9.4.01 Contact with stinging insects such as bees, hornets, and wasps may result in site personnel experiencing adverse health affects that range from mildly uncomfortable to life-threatening; therefore, stinging insects present a serious hazard to site personnel, and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects.

10.9.4.02 Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows.

- The nests for these insects are frequently found in the type of remote wooded grassy areas where many waste sites are located.
- The nests can be situated in trees, rocks, bushes, or in the ground, and they are usually difficult to see.
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active.
- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling that can leave the worker incapacitated and in need of medical attention.
- Some people are hypersensitive to the toxins injected by a sting and experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock. Anaphylactic shock manifests itself rapidly and is characterized by extreme swelling of the body, eyes, face, mouth, and respiratory passages. In some people, the hypersensitivity that causes anaphylactic shock can accumulate over time and exposure; therefore, the fact that someone was stung previously and did not experience an

allergic reaction does not guarantee that he or she will not have an allergic reaction after being stung again.

10.9.4.03 Because of the high probability of contact with stinging insects, all site personnel will comply with the following safe work practices.

- If a worker knows that he or she is hypersensitive to bee, wasp, or hornet stings, he or she must inform the UXOQC/SO of this condition prior to participation in site activities.
- All site personnel will be watchful for the presence of stinging insects and their nests and will advise the UXOQC/SO if a stinging insect nest is located or suspected in the area.
- Any nests located on site will be flagged, and site personnel will be notified of their presence.
- If stung, site personnel will immediately report the UXOQC/SO to obtain treatment and to allow the UXOQC/SO to observe them for signs of allergic reaction.
- Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times.

10.9.5 Biting Insects

Biting insects such as mosquitoes, flies, and fleas may be encountered on site. The use of insect repellents will be encouraged by the UXOQC/SO if deemed necessary. Mosquito-transmitted diseases include Dengue fever, which may prove deadly in one of its varieties.

10.9.6 Spiders, Scorpions, and Centipedes

10.9.6.01 Spider bites, especially those of the black widow and the brown recluse, can cause significant adverse heath affects, and no effective first-aid treatment exists for either of these bites. Except for very young, very old, or weak victims, these spider bites are not considered to be life-threatening, but medical treatment must be sought to reduce the extent of damage caused by the injected toxins. If either of these spiders are suspected or known to be on site, the UXOQC/SO will brief the site personnel on identification and avoidance of the spiders. As in the case of stinging insects, site personnel should report to the UXOQC/SO if they locate either of these spiders on site or if they notice any type of bite while involved in site activities.

10.9.6.02 The black widow is a coal-black bulbous spider 0.75 inch to 1.5 inches long, with a bright red hourglass shape on the underside of its abdomen. Black widows are usually found in dark, moist locations, especially under rocks and rotting logs, and may even be found in outdoor toilets, where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite
- Appearance of small punctures (but sometimes none are visible)
- After 15 to 60 minutes, intense pain at the site of the bite, which spreads quickly and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils, and generalized swelling of the face and extremities

10.9.6.03 The brown recluse is brownish to tan in color, rather flat, and 0.5 to 0.625 (5/8) inch long, with a dark brown violin shape on the underside. It may be found in trees or in dark locations. Victims of a brown recluse bite may exhibit the following signs or symptoms:

- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite
- Formation of a large, red, swollen, pulsating lesion with a bull's-eye appearance
- Systemic effects such as a generalized rash, joint pain, chills, fever, nausea, and vomiting
- Possible severe pain after 8 hours, with the onset of tissue necrosis

10.9.6.04 Several dozen species of scorpions inhabit the Antilles. The sting of West Indian species can be painful, but none are known to be fatal to humans.

10.9.6.05 The sting of local centipedes is painful and may in rare cases require medical treatment.

10.9.7 Hanta Virus

10.9.7.01 Hanta virus was first recognized as a unique health hazard in 1993, with 158 cases reported as of March 17, 1997. Outbreaks have been limited principally to the Four Corners region of Arizona, New Mexico, Utah, and Colorado. Four different strains of hanta virus exist, and cases have been reported in 26 different states. The virus is most active when the temperature is between 45ºF and 72ºF. The virus dies quickly when exposed to sunlight.

10.9.7.02 Hanta virus is an airborne virus spread through the urine and feces of infected rodents. A person is infected with the virus by breathing in particles released into the air when infected rodents, their nests, or their droppings are disturbed. This can happen when a person is handling rodents, disturbing rodent nests or burrows, cleaning buildings where rodents have made a home, or working outdoors. Symptoms of hanta virus infection include fever and muscle aches, nausea, diarrhea, dry non-productive cough, chills, vomiting, and abdominal pain.

10.9.7.03 Hanta virus is not expected to be encountered at this site, but the following precautions should be taken.

- Air out any closed sheds or buildings before entering.
- Make sure the buildings are properly sealed from rodent access.
- Trap until all mice are gone, using care to disinfect any trapped rodents.
- Clean up droppings only after the area has been disinfected.
- In areas of potential exposure, always wear a respirator that utilizes high efficiency particulate air (HEPA) rated filters.
- Dispose of all caught rodents, droppings, and nesting materials in an appropriate manner.

10.10 Munitions and Explosives of Concern

If MEC is located on site, its location will be marked and the on-site government representative will be notified of its presence. All UXO-qualified personnel will follow the safe work practices in the Work Plan, and all non-UXO-qualified personnel will comply with the following safe work practices.

- Non-UXO-qualified personnel will receive site-specific MEC recognition training prior to participation in site activities.
- No soil-penetrating activities will be allowed without the area first being cleared by UXO-qualified personnel.
- Non-UXO-qualified personnel will be escorted on site by UXO-qualified personnel until such a time that the area is cleared.
- Once an area has been cleared and flagged, non-UXO-qualified personnel may perform duties in the area unescorted, but they shall not leave the cleared area unescorted.
- No excavation or soil-penetrating activities will be conducted in an area unless previously cleared by UXO-qualified personnel.
- Non-UXO-qualified personnel will not touch or disturb any object that could potentially be MEC-related, and they will immediately notify the nearest UXO-qualified person of the presence of the object.

11.0 Safety Logs, Reports, and Recordkeeping

The following logs and records will be completed, retained, and submitted to the EEG site manager for compilation and included with the daily report. Copies of forms are provided in Appendix F of the Work Plan.

11.1 Safety Log

The EEG UXOQC/SO will maintain a safety log of all safety-related activities. The EEG UXOQC/SO is responsible for ensuring that safety and health activities for the day, as well as tailgate safety briefing minutes, are part of the log. When safety and health deficiencies are noted during daily inspections, then the measures, timetable, and individual responsible for correcting the deficiencies will be noted in the safety log.

11.2 Tailgate Safety Briefings and Training

The EEG UXOQA/SO is responsible for ensuring that all tailgate safety briefings and training conducted relative to job site activities is appropriately documented on the Tailgate Safety Briefing / Training Forms.

11.3 Visitor Log

A Visitor Log will be maintained at the entrance to all work sites to record visit to the job site.

11.4 Reports

The following reports will be submitted as required by applicable CEHNC and OSHA regulations.

- If a reportable injury, illness, or accident occurs at the job site, the appropriate form will be completed and forwarded within 24 hours to the EEG project manager. The Accident / Injury Investigation form will be completed for all accidents and illnesses that are work-related, as well as for near misses. If a serious accident occurs that results in lost days and/or damage in excess of $2,000, ENG Form 3394, in accordance with AR 385-40 and USACE supplements to that regulation, will be submitted to the EEG project manager for submittal to the CEHNC project manager.
- Daily reports will be submitted to the EEG project manager and will include Tailgate Safety Briefing / Training Form, accident reports, Visitor Log, and a description of safety activities, inspections, weather and site conditions, etc. that occurred during the day.

11.5 Recordkeeping

Site records will be kept in three-ring binders or in field notebooks. Additionally, site data will be kept on site in a database that will be updated daily. All recordkeeping will be in accordance with applicable OSHA and CEHNC standards and regulations.

ATTACHMENT B

Material Safety Data Sheets

THE SOMERSET REFINERY, INC

600 MONTICELLO ST.
P.O. BOX 1547
SOMERSET, KY 42502

Updated 10 Mar 2000
Bruce C. McGowan

MATERIAL SAFETY DATA SHEET

DieLsRd

EMERGENCY NUMBERS: ATSDR (24hr) (404) 639-0615 Somerset Refiner (606) 678-8194

I. PRODUCT IDENTIFICATION

PRODUCT: **Diesel Fuel, Road, Low Sulfur .05%** CHEMICAL NAM Petroleum Distillate

CHEMICAL FAMILY: Petroleum Hydrocarbon FORMULA: C10 - C | CAS #: 68476-30-2

NATIONAL FIRE PROTECTION ASSOCIATION RATING CODE:	HEALTH CODE: 1
	FIRE CODE: 2
LEAST (0), SLIGHT (1), MODERATE (2), HIGH (3), EXTREME (4)	REACTIVITY COD 1

II. COMPONENTS

INGREDIENT	%	OSHA LIMIT	TLV
#2 Diesel Fuel (CAS # 68476-30-2)	100	Not Established	Not Established
Aliphatic Hydrocarbons (CAS # 68476-34-6)	> 95		
SARA Title III, Section 313 Reportable Chemicals:			
Biphenyl (CAS # 92-52-4)	0.4 - 1.2		
Naphthalene (CAS # 91-20-3)	0.5 - 1.5	Note: The Permissible Exposure Limit (PEL/OSHA) for petroleum distllates is 200 mg/m3 . NIOSH has recommended a 10 hour TWA of 100 mg/m^3 for kerosene (1977).	
Xylene Mixture (CAS # 1330-20-7)	0.5 - 1.5		

III. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT 330 - 760 ^{O}F	VAPOR PRESSURE < 1 mmHg @ 77^{O}F	EVAPORATION (Ethyl Ether = 1) < 1
VOLATILE BY VOLUME % 100	AVERAGE MOLAR MASS Varies	APPEARANCE Clear Straw Color Liquid
ODOR AND THRESHOLD Petroleum~500 ppm	MELTING POINT Not Applicable	DENSITY OF VAPOR (Air = 1) 5 - 6
SPECIFIC GRAVITY (Water = 1) 0.825 API Gravity - 40 @ 60^{O}F	VISCOSITY 4.3 cSt @ 100^{O}F	SOLUBILITY (g/100g Water @ 20^{O}C) Negligible

IV. FIRE PROTECTION INFORMATION

FLASH POINT / METHOD	AUTOIGNITION TEMPERAT	FLAMMABLE LIMITS (% Volume in Air)	
$145^{\circ}F$ / COC	$490^{\circ}F$ or Higher	LOWER	UPPER
		0.4	6.0

EXTINGUISHING MEDIA AND FIREFIGHTING PROCEDURES

Carbon dioxide, dry chemical, or foam. Water stream may spread fire, use water spray only to cool containers expose to fire. If leak or spill has not ignited, use water spray to disperse the vapors and flush spills away from sources of potential ignition. Do not enter enclosed or confined spaces without proper protective equipment including a full face self-contained breathing apparatus in the positive pressure demand mode when fighting fires.

HAZARDOUS DECOMPOSITION PRODUCTS

Dense smoke may be generated while burning. Products of combustion may contain carbon monoxide, carbon dioxid and other toxic materials.

FIRE AND EXPLOSION HAZARDS

Avoid undue exposure to air. Avoid heat, sparks and flame. Can form flammable mixtures with air. Explosion hazar in fire situation. Vapor heavier than air and may travel considerable distance to a source of ignition and flash back.

INCOMPATABILITY WITH OTHER MATERIALS

Incompatible or can react with strong oxidizers.

HAZARDOUS POLYMERIZATION	CHEMICAL STABILITY
[X] WILL NOT OCCUR [ ] WILL OCCUR	[X] STABLE [ ] UNSTABLE

V. HEALTH EFFECTS

INHALATION

Medical conditions aggravated by exposure: kidney, liver or blood disorders.
Acute effects: Possible effects include nasal and respiratory irritation, breathlessness, headache, nausea, dizziness, euphoria, drowsiness, fatigue, hearing loss, pneumonitis, pulmonary edema, cardiac irregularities, central nervous system depression, convulsions and loss of conciousness.
Chronic effects: Possible effects include kidney, liver and blood disorders.

EYE CONTACT

Acute: Moderate Irritation

SKIN CONTACT

Chronic: Irritation, defatting, dermatitis.

INGESTION

Acute: Causes burning sensation in mouth, throat and stomach. Possible effects include nasal and respiratory irritation, breathlessness, headache, nausea, dizziness, drowsiness, euphoria, fatigue, diarrhea, vomiting, chemical pneumonitis, pulmonary edema, cardiac irregularities, kidney failure, central nervous system depression, convulsions and loss of conciousness. Aspiration of material into the lungs can cause chemical pneumonitis which can be fatal.

POTENTIAL CARCINOGEN OR CARCINOGEN

- [ ] NOT APPLICABLE
- [X] INTER. AGENCY FOR RESEARCH ON CANCER
- [ ] NATIONAL TOXICOLOGY PROGRAM
- [ ] OSHA

The International Agency For Research on Cancer(IARC) has determined that there is evidence for the carcinogenicity of fuel oil in humans.

IARC has determined that there is sufficient evidence for the carcinogenicity in experimental animals of whole engine exhaust and extracts of diesel engine exhaust particles. IARC determined that there is only limited evidence for the carcinogenicity in humans of diesel exhaust. However, IARC's overall evaluation has resulted in the IARC designation of diesel engine exhaust as probably carcinogenic to humans (group 2A) because of the certain engine exhaust components.

VI. FIRST AID PROCEDURES

INHALATION

Move exposed person to fresh air. If breathing is difficult give oxygen. If breathing has stopped perform artificial respiration. Get medical attention as soon as possible.

EYE CONTACT

Immediately flush eyes with water for a minimum of 15 minutes, occasionally lifting the lower and upper lids. Get medical attention promptly.

SKIN CONTACT

If clothing soaked, immediately remove clothing and wash skin with soap and water. Launder clothing before reuse. If any adverse reaction occurs get medical attention promptly.

INGESTION

DO NOT INDUCE VOMITING. Immediately give 2 glasses of water. Never give anything by mouth to an unconcious person. Get medical help as soon as possible.

Note to Physicians: Activated charcoal mixture may be beneficial. Suspend 50g activated charcoal in 400mL water and mix well. Administer 5mL/kg or 350mL for an average adult.

VII. EMPLOYEE PROTECTION

RESPIRATORY PROTECTION

Respiratory protection is not required under conditions of normal use. If vapor or mist is generated when the material is heated or handled use a full-face organic vapor respirator or full-face respirator supplied with air. When fighting fires use a self-contained breathing apparatus in the positive pressure-demand mode.

PROTECTIVE CLOTHING

EYES - Chemical goggles or face shield.
SKIN - Gloves: Nitrile, neoprene or other material resistant to petroleum.

VENTILATION

Provide sufficient ventilation to keep air concentration below the specified exposure or flammable limits. Request assistance of safety and industrial hygiene personnel to determine air concentrations.

VIII. TRANSPORTATION AND STORAGE INFORMATION

DOT HAZARDOUS MATERIAL [X] YES [ ] NO	DOT HAZARD CLASS # 3 Flammable Liquid
DOT SHIPPING NAME AND #2 DIESEL FUEL NA1993 DOT LABEL(S): FLAMMABLE LIQUID	

STORAGE

Do not store near flame, heat, sparks, or strong oxidizers. Storage area should be well ventilated.
Store as NFPA Class II Combustible Liquid.

IX. ENVIRONMENTAL PROTECTION INFORMATION

SPILLS

Notify emergency response personnel. Evacuate area and remove ignition sources. Build dike to contain flow. Remove free liquid, do not flush to sewer or open water. Pick up with inert absorbent and place in closed container for disposal. If flash point of residue is under 140°F utilize hazardous waste manifest and permitted hazardous waste disposal site. If flash point is above 140°F utilize permitted industrial waste disposal site.

EPA HAZARDOUS WASTE ☐ Yes ☒ No	EPA WASTE CODE None WASTE CHARACTERISTIC: None

WASTE DISPOSAL

Utilize liscensed waste disposal company. Consider incineration or recycling if feasible. Based on flash point, utilize permitted hazardous waste disposal site and manifest or permitted industrial waste disposal site. This product as produced is not specifically listed as an EPA RCRA hazardous waste according to federal regulations (40 CFR 260.271. However, when discarded or disposed of, it may meet the criteria of an "ignitable" hazardous waste. This material could become a hazardous waste if mixed or contamianted with a listed hazardous waste. It is the responsibility of the user to determine if disposal material ia hazardous according to federal, state, and local regulations.

DISCLAIMER

The information and recommendations contained in this publication have been complied from sources believed reliable and to represent the best current opinion on the subject at the time of publication. Since we cannot anticipate or control the many different conditions under which this information or our product may be used, we make no guarantee that the recommendations will be adequate for all individuals or situations. Each user of the product described herein should determine the suitability of the described product for his or her particular purpose and should comply with all federal and state rules and regulations concerning the described product.

MANAGER'S SIGNATURE	DATE

MATERIAL SAFETY DATA SHEET

FLEETLINE
SAE 5W-20 MOTOR OIL

MSDS NO. FLE 7450 PAGE 1

DENNIS K. BURKE INC.

284 Eastern Ave. • PO Box 6069 • Chelsea, MA 02150
Telephone: (617) 884-7800 • Fax: (617) 884-7638

Additional copies of this MSDS can be obtained by calling 1-800-289-2875 or downloaded from our website at www.burkeoil.com

SECTION 1
PRODUCT INFORMATION

TRADE NAME (As used on label and list)
FLEETLINE
SAE 5W-20 MOTOR OIL

CHEMICAL NAME/SYNONYMS
LUBRICATING OIL

CHEMICAL FAMILY — **PETROLEUM HYDROCARBONS**

CAS NUMBER — **MIXTURE**

PRODUCT CODE
FLE 7450, FLE 7451, FLE 7452, FLE 7455

PREPARATION DATE
MAY 15, 2003

24-HOUR EMERGENCY ASSISTANCE
CHEMTREC 1-800-424-9300
In case of an accident involving hazardous materials, the Chemical Transportation Emergency Center (CHEMTREC) which is a voluntary program of the Chemical Manufacturer's Association (CMA) operates a 24-hour nationwide telephone number which can be contacted for assistance.

NATIONAL EMERGENCY RESPONSE CENTER 1-800-424-8802

MASSACHUSETTS POISON INFORMATION CENTER (617) 232-2020

GENERAL ASSISTANCE
DENNIS K. BURKE, INC. 1-800-289-2875

SECTION 2
HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

DOES PRODUCT CONTAIN HAZARDOUS INGREDIENTS? ... NO

DOES PRODUCT CONTAIN CARCINOGENS (NTP, IARC, or OSHA)? .... NO

CHEMICAL/COMMON NAME	CAS NUMBER	PERCENT	OSHA-PEL	ACGIH-TLV
Solvent Dewaxed Light Paraffinic Distillate	64742-56-9	70-80	5 mg/m³*	5 mg/m³*
Additives	Mixture	15-20	–	–

The additive mixtures in this product have been declared a trade secret by the additive manufacturer.

* If used in applications where a mist may be generated, observe a TWA/PEL of 5 mg/m³ for mineral oil mist (OSHA and ACGIH).

This product contains the following toxic chemical category subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act (SARA) of 1986 and 40 CFR 372. (percent by weight):

Zinc Compound – 1.2% or Zinc in compound form – 0.12%

SECTION 3
PHYSICAL/CHEMICAL CHARACTERISTICS

BOILING POINT ...... > 330°C (625°F)

VAPOR PRESSURE (mm Hg at 20°) . 0

VAPOR DENSITY (AIR = 1) .. not volatile

SPECIFIC GRAVITY (WATER = 1) . 0.86 to 0.87

MELTING POINT ..... < –36°C (–33°F)

EVAPORATION RATE (n-BUTYL ACETATE = 1) 0

SOLUBILITY IN WATER .... 0 at 20°C

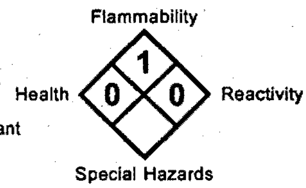
APPEARANCE AND ODOR – Amber liquid with a motor oil odor.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM (HMIS)

HEALTH 0
FLAMMABILITY 1
REACTIVITY 0
PROTECTION 0

NFPA FIRE HAZARD SYMBOL*

4 - Extreme
3 - High
2 - Moderate
1 - Slight
0 - Insignificant



SARA TITLE III INFORMATION

ACUTE HAZARD (Immediate Health) ...... NO
CHRONIC HAZARD (Delayed Health) .... NO
FIRE HAZARD .... NO
SUDDEN PRESSURE RELEASE HAZARD ..... NO
REACTIVITY HAZARD .... NO

DOT REQUIREMENTS

DOT PROPER SHIPPING NAME
PETROLEUM LUBRICATING OIL

DOT HAZARD CLASS
NON-HAZARDOUS

DOT LABELS REQUIRED
NONE

DOT PLACARDS REQUIRED
NONE

This product has a flash point in excess of 200°F and does not require placarding.

SECTION 4
FIRE AND EXPLOSION HAZARD DATA

FLASH POINT (Method Used) .... COC = 220°C (428°F)

FLAMMABLE LIMITS .... LEL = NDA UEL = NDA

EXTINGUISHING MEDIA – Dry Chemical, Carbon Dioxide, Foam and Water Fog.

SPECIAL FIRE FIGHTING PROCEDURES – Use a smothering technique to extinguish a combustible liquid fire. Do not use a forced water stream directly on oil fires, as this will scatter the fire. Use a water fog to cool fire-exposed containers, structures, and to protect personnel.

(• continued on page 2)

SPECIAL FIRE FIGHTING PROCEDURES

(• continued from page 1)

If leak or spill has not ignited, ventilate area to protect personnel attempting to stop leak. Use water to flush spills away from sources of ignition. Do not flush down public sewers or other drainage systems.

UNUSUAL FIRE AND EXPLOSION HAZARDS – This material will not burn unless preheated. Irritating or toxic substances may be emitted upon thermal decomposition. Containers may explode in heat of fire.

SECTION 5

REACTIVITY DATA

STABILITY .... STABLE

CONDITIONS TO AVOID FOR STABILITY – Avoid heat, sparks and open flames. Prevent vapor accumulation.

INCOMPATIBILITY (Materials To Avoid) — This product may react with strong oxidizing agents such as hydrogen peroxide, bromine, and chromic acid.

HAZARDOUS DECOMPOSITION – Carbon monoxide and carbon dioxide from burning. Oxides of phosphorous from burning. Oxides of sulfur.

HAZARDOUS POLYMERIZATION .... NONE

SECTION 6

HEALTH HAZARD DATA

EYE CONTACT – Practically non-irritating.

SKIN CONTACT – Slightly irritating. Repeated or prolonged contact with the skin could cause redness, itching, inflammation or cracking. Symptoms may include discoloration, swelling, pain or a feeling of heat.

INJECTION – High pressure skin injections may not appear serious at first; tissue will become swollen, discolored and extremely painful.

DERMAL TOXICITY – Practically non-toxic to internal organs.

INHALATION – Low risk at ambient temperatures. Prolonged breathing of vapors can cause headache, dizziness, nausea, respiratory irritation or chemical pneumonitis.

INGESTION – Low toxicity. If less than one ounce is ingested, material may pass through the system without harm. On ingestion of large quantities, slight GI discomfort, diarrhea and headaches may occur.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE – Pre-existing dermatitis may be aggravated.

EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT – Flush immediately with fresh water. Remove contact lenses if worn .Eyelids should be held away from the eyeball to ensure thorough rinsing. Get medical attention if irritation persists.

SKIN CONTACT – Remove contaminated clothes immediately. Wash skin thoroughly with soap and water. Get medical attention if irritation persists. Wash contaminated clothes.

INJECTION – High pressure injections are serious medical emergencies. Get medical attention immediately.

INHALATION – Remove victim from source of exposure to fresh air. If breathing is difficult, provide oxygen. Get medical attention.

INGESTION – Do not induce vomiting. Unless large quantities are ingested, no treatment is necessary. However, get medical attention.

NOTES TO PHYSICIAN – In case of skin injection, prompt debridement of the wound may be necessary to minimize necrosis and tissue loss.

SECTION 7

PRECAUTIONS FOR SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED – Shut off ignition sources; no flares, smoking or flames in hazard area. Stop leak if you can do it without risk.

To clean small spills, transfer bulk of product into another container. Absorb residue with an inert material such as earth, sand or oil absorbent. Sweep up and dispose of as solid waste in accordance with applicable federal, state and local regulations.

Considered to be a water pollutant, prevent releases of this product from contaminating soil and water, or from entering drainage and sewer systems. Contain liquid to prevent further contamination of soil, surface water or groundwater.

The Clean Water Act requires the reporting of any discharge of oil and petroleum (in any kind or form) into surface waters. Immediately call the National Emergency Response Center at 1-800-424-8802.

WASTE DISPOSAL METHODS – Place contaminated materials in containers and dispose of in accordance with applicable regulations.

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE – Store in tightly closed containers in cool, dry, isolated, well-ventilated area away from heat, sources of ignition and incompatibles.

EMPTY CONTAINERS – Empty containers may contain flammable/ combustible residue or vapors. Do not cut, drill, weld, reuse or dispose of containers unless precautions are taken against these hazards.

SECTION 8

CONTROL MEASURES

RESPIRATORY PROTECTION – NIOSH/MSHA approved self-contained breathing apparatus or supplied-air mask must be available for non-routine and emergency use. Ventilation may be used to control or reduce airborne concentrations.

VENTILATION

LOCAL EXHAUST .... NA

MECHANICAL (General) .... NA

SPECIAL .... NA

OTHER .... NA

SKIN PROTECTION – Wear neoprene gloves and protective clothing to prevent skin contact.

EYE PROTECTION – Wear safety glasses to prevent eye contact.Have eye washing facility readily available where eye contact can occur.

WORK PRACTICES – Do not use or store near flame, sparks or hot surfaces. Use only in well ventilated area. Keep container closed. Do not weld, heat or drill container. Replace cap or bung. Do not use pressure to empty drum or explosion may result. Keep head away from container when opening or dispensing.

HYGIENIC PRACTICES – Launder soiled clothing. Wash thoroughly with soap and water after handling.

NA = NOT APPLICABLE NDA = NO DATA AVAILABLE

SOMERSET

THE SOMERSET REFINERY, INC

600 MONTICELLO ST.
P.O. BOX 1547
SOMERSET, KY 42502

Update 10 Mar 2000
Bruce C. McGowan
NoO2gas

MATERIAL SAFETY DATA SHEET

EMERGENCY NUMBERS: ATSDR (24hr) (404) 639-0615 Somerset Refiner (606) 678-8194

I. PRODUCT IDENTIFICATION

PRODUCT: **Unleaded Gasoline , All Gra** CHEMICAL NAME: Gasoline, Petrol

This MSDS applies to all grades of unoxygenated (no ethanol added) gasoline supplied by Somerset Oil.

a.) 87 Octane Unleaded Gasoilne
b.). 89 Octane Unleaded Gasoline
c.) 91 Octane Unleaded Gasoline

CHEMICAL FAMILY: Petroleum Hydrocarbon FORMULA: C3 - C | CAS #: 86290-81-5

NATIONAL FIRE PROTECTION ASSOCIATION RATING CODE: LEAST (0), SLIGHT (1), MODERATE (2), HIGH (3), EXTREME (4	HEALTH CODE: 1 FIRE CODE: 3 REACTIVITY COI 0

II. HAZARDOUS COMPONENTS

INGREDIENT	%	OSHA LIMIT	TLV
Gasoline (CAS # 86290-81-5)	100	TWA - 500 ppm	TWA - 300 ppm STEL - 500 ppm
Benzene (CAS # 71-43-2)	0.1 - 5	TWA - 0.5 ppm Ceiling - 1 ppm	TWA - 0.1 ppm STEL - 5 ppm
Cumene (CAS # 98-82-8)	0 - 2	TWA - 50 ppm	TWA - 50 ppm
Ethylbenzene (CAS # 100-41-4)	1 - 2	TWA -100 ppm	TWA - 100 ppm STEL - 125 ppm
Pseudocumene (CAS # 95-63-6)	0 - 3	TWA - 25 ppm	TWA - 25 ppm
Toluene (CAS # 108-88-3)	5 - 15	TWA - 200 ppm Ceiling - 300 ppm	TWA - 50 ppm STEL - 150 ppm
Xylene (CAS # 1330-20-7)	4 - 10	TWA - 100 ppm	TWA - 100 ppm STEL - 150ppm

III. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT 78 - 90 ^{O}F	VAPOR PRESSURE 325 - 525 mmHg @ 68^{O}F	EVAPORATION (Ethyl Ether = 1) Estimated 1.5 Times Slower
VOLATILE BY VOLUME % 100	AVERAGE MOLAR MASS Approximately 100	APPEARANCE Red Liquid
ODOR AND THRESHOLD Gasoline 10ppm	MELTING POINT Not Applicable	DENSITY OF VAPOR (Air = 1) 3 - 4
SPECIFIC GRAVITY (Water = 1) 0.70 - 0.73	VISCOSITY Not Applicable	SOLUBILITY (g/100g Water @ 20^{O}C) Negligible

IV. FIRE PROTECTION INFORMATION

FLASH POINT / METHOD -45^{O}F / Tag Closed Cup	AUTOIGNITION TEMPERAT 536^{O}F or Higher	FLAMMABLE LIMITS (% Volume in Air LOWER 1.4 UPPER 7.6

EXTINGUISHING MEDIA AND FIREFIGHTING PROCEDURES

Carbon dioxide, dry chemical, or foam. Water stream may spread fire, use water spray only to cool containers exposed to fire. If leak or spill has not ignited, use water spray to disperse the vapors and flush spills away from sources of potential ignition. Do not enter enclosed or confined spaces without proper protective equipment including a full face self-contained breathing apparatus in the positive pressure demand mode when fighting fires.

HAZARDOUS DECOMPOSITION PRODUCTS

Products of combustion may contain carbon monoxide, carbon dioxide and other toxic materials.

FIRE AND EXPLOSION HAZARDS

Avoid undue exposure to air. Avoid heat, sparks and flame. Can form flammable mixtures with air and flash at room temperature. Explosion hazard in fire situation. Vapor heavier than air and may travel considerable distance to a source of ignition and flash back.

INCOMPATABILITY WITH OTHER MATERIALS

Incompatible or can react with strong oxidizers.

HAZARDOUS POLYMERIZATION	CHEMICAL STABILITY
[X] WILL NOT OCCUR [ ] WILL OCCUR	[X] STABLE [ ] UNSTABLE

V. HEALTH EFFECTS

INHALATION

Medical conditions aggravated by exposure: kidney, liver or blood disorders.
Acute effects: Possible effects include headache, nasal and respiratory irritation, nausea, dizziness, euphoria, breathlessness, drowsiness, fatigue, hearing loss, pnemonitis, pulmonary edema, cadiac irregularities, central nervous system depression, convulsions and loss of conciousness.
Chronic effects: Possible effects include kidney, liver and blood disorders, including anemia and leukemia. Laboratory animals exposed for a long duration have been shown to develop kidney and liver tumors.

EYE CONTACT

Acute: Irritation

SKIN CONTACT

Acute: Possible narcosis.
Chronic: Irritation, dermatitis.

INGESTION

Acute: Possible effects include headache, nasal and respiratory irritation nausea, dizziness, drowsiness, euphoria, breathlessness, fatigue, pneumonitis, pulmonary edema, cardiac irregularities central nervous system depression, convulsions and loss of conciousness. Aspiration hazard if ingested.

REPORTED AS POTENTIAL CARCINOGEN OR CARCINOGEN

Contains: Benzene, Cumene, Toluene and Xylene.	[ ]	NOT APPLICABLE
	[X]	INTER. AGENCY FOR RESEARCH ON CANCER
	[X]	NATIONAL TOXICOLOGY PROGRAM
	[X]	OSHA

OSHA REQUIRED LABEL: DANGER, CONTAINS BENZENE, CANCER HAZARD

VI. FIRST AID PROCEDURES

INHALATION

Move exposed person to fresh air. If breathing has stopped, perform artificial respiration. If breathing is difficult give oxygen. Get medical attention as soon as possible.

EYE CONTACT

Immediately flush eyes with water for a minimum of 15 minutes, occasionally lifting the lower and upper lids.
Get medical attention promptly.

SKIN CONTACT

If clothing soaked, immediately remove clothing and wash skin with soap and water. Launder clothing before wearing. If any adverse reaction occurs get medical attention promptly.

INGESTION

DO NOT INDUCE VOMITING. Immediately give 2 glasses of water. Never give anything by mouth to an unconcious person. Get medical help as soon as possible.

Note to Physicians: Activated charcoal mixture may be beneficial. Suspend 50g activated charcoal in 400mL water and mix well. Administer 5mL/kg or 350mL for an average adult.

VII. EMPLOYEE PROTECTION

RESPIRATORY PROTECTION

Up to 10ppm benzene/1000ppm gasoline - Half-mask organic respirator.
Up to 50ppm benzene/5000ppm gasoline - Full-face organic vapor respirator or full-face respirator supplied with air.
Greater than 50ppm benzene/5000ppm gasoline, fire fighting or unknown concentration - Self-contained breathing apparatus with positive pressure.

PROTECTIVE CLOTHING

EYES - Chemical goggles or face shield.
SKIN - Gloves: Nitrile, neoprene or other material resistant to gasoline.

VENTILATION

Use in well ventilated area order to keep air concentration below 300ppm gasoline and 0.10ppm benzene. Request assistance of safety and industrial hygiene personnel to determine air concentrations.

VIII. TRANSPORTATION AND STORAGE INFORMATION

DOT HAZARDOUS MATERIAL [X] YES [ ] NO	DOT HAZARD CLASS # 3 Flammable Liquid

DOT SHIPPING NAME ANI GASOLINE UN1203
DOT LABEL(S): FLAMMABLE LIQUID

STORAGE

Do not store near flame, heat, sparks, or strong oxidizers.
Storage area should be well ventilated.
Store as OSHA Class IB Flammable Liquid.

IX. ENVIRONMENTAL PROTECTION INFORMATION

SPILLS

Notify emergency response personnel. Evacuate area and remove ignition sources. Build dike to contain flow. Remove free liquid, do not flush to sewer or open water. Pick up with inert absorbent and place in closed container for disposal. If flash point of residue is under 140^{O}F utilize hazardous waste manifest and permitted hazardous waste disposal site. If flash point is above 140^{O}F utilize permitted industrial waste disposal site.

EPA HAZARDOUS WASTE [X] Yes [ ] No	EPA WASTE CODE NO.: D 001 and D 018 WASTE CHARACTERISTIC: Ignitable

WASTE DISPOSAL

Utilize liscensed waste disposal company. Consider incineration or recycling if feasible. Based on flash point, utilize permitted hazardous waste disposal site and manifest or permitted industrial waste disposal site.

DISCLAIMER

The information and recommendations contained in this publication have been complied from sources believed reliable and to represent the best current opinion on the subject at the time of publication. Since we cannot anticipate or control the many different conditions under which this information or our product may be used, we make no guarantee that the recommendations will be adequate for all individuals or situations. Each user of the product described herein should determine the suitability of the described product for his or her particular purpose and should comply with all federal and state rules and regulations concerning the described product

MANAGER'S SIGNATURE	DATE

OWEN COMPLIANCE SERVICES, INC.

Material Safety Data Sheet
(MSDS-SC)

PRODUCT IDENTIFICATION	
Product Name	Shaped Charges
Trade Names and Synonyms	Casing cutters, Junk Shots, Linear Shaped Charges (LSC), Perforators, Severing Tools, Tubing Cutters, Split Shot® Cutters
Manufacturer/Distributor	Various manufacturers including Owen Oil Tools, Inc., GOEX International, Inc., Halliburton Energy Services (Jet Research Center), Shaped Charged Specialists, Harrison Jet Guns, Atlas Wireline, Schlumberger Perforating Center, High Energy International
Transportation Emergency	**800-255-3924 (24 hrs -- *CHEM • TEL*)**

PREVENTION OF ACCIDENTS IN THE USE OF EXPLOSIVES

The prevention of accidents in the use of explosives is a result of careful planning and observance of the best known practices. The explosives user must remember that he is dealing with a powerful force and that various devices and methods have been developed to assist him in directing this force. He should realize that this force, if misdirected, may either kill or injure both him and his fellow workers.

WARNING

All explosives are dangerous and must be carefully handled and used following approved safety procedures either by or under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, or ordinances. If you have any questions or doubts as to how to use any explosive product, **DO NOT USE IT** before consulting with your supervisor, or the manufacturer, if you do not have a supervisor. If your supervisor has any questions or doubts, he should consult the manufacturer before use.

HAZARDOUS COMPONENTS			
Material or Component	**CAS No.**	**TLV**	**PEL**
RDX (Cyclotrimethylenetrinitramine)	00121-82-4	1.5 mg/m^3	1.5 mg/m^3
HMX (Cyclotetramethylenetetranitramine)	026914-41-0	NE	NE
HNS (Hexanitrostilbene)	20062-22-0	NE	NE
PYX (Picrylaminodinitropyridine)	38082-89-2	NE	NE
Desensitizing Wax	N/A	NE	NE
Aluminum	07429-90-5	5 mg/m^3	10 mg/m^3
Corrosion resistant steel	N/A	NE	NE
Iron	07439-89-6	5 mg/m^3	10 mg/m^3
Graphite	07782-42-5	15mppcf (TWA)	2.5 mg/m3
Copper	07440-50-8	1 mg/m^3	1 mg/m^3
Lead	07439-92-1	0.15 mg/m^3	50 μg/m^3
Tungsten	07440-33-7	5 mg/m^3	5 mg/m^3
Zinc	07440-66-6	NE	NE
N/A = Not assigned NE = Not established			

PHYSICAL DATA
Explosives shaped charges contained in metal, glass, or ceramic cases.

HAZARDOUS REACTIVITY	
Instability	Detonates with friction, impact, heat, low level electrical current, electrostatic or RF energy.
Incompatibility	Acids and alkalis
Hazardous decomposition	Detonation produces hazardous fragments. Gases produced may contain carbon monoxide and nitrogen oxides.
Polymerization	Polymerization will not occur.

FIRE AND EXPLOSION DATA	
Flashpoint	Not applicable
Extinguishing media	None
Special fire fighting procedures	**ALL EXPLOSIVES: DO NOT FIGHT EXPLOSIVES FIRES.** Try to keep fire from reaching explosives. Isolate area. Guard against intruders. Division 1.1 Explosives: Evacuate the area for 5000 feet (1 mile). Consult *the 2000 Emergency Response Guidebook, Guide 112* for further details. Division 1.4 Explosives: Evacuate the area for 1500 feet (1/3 mile). Consult *the 2000 Emergency Response Guidebook, Guide 114* for further details.
Unusual fire and explosion hazards	May detonate with impact or on heating.

HEALTH HAZARDS	
General	Shaped Charges do not present health hazards in normal handling and use; however, the products are Division 1.1 or 1.4 explosives, and detonation may cause severe physical injury, including death. All explosives are dangerous and must be handled carefully and used following approved safety procedures under the direction of competent, experienced persons in accordance with all applicable federal, state, and local laws, regulations, and ordinances. Inhalation of explosives powders may cause nervous system irregularities including headaches and dizziness. Nitrogen oxides generated during use are skin, eye, and respiratory tract irritants.
Carcinogenicity	None of the components of shaped charges are listed as a carcinogen by NTP, IARC, or OSHA.

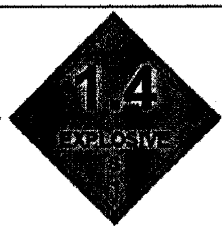
FIRST AID	
Inhalation	Not a likely route of exposure. If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably by mouth-to-mouth. If breathing is difficult, give oxygen. Seek prompt medical attention.
Eye and skin contact	Not a likely route of exposure.
Ingestion	Not a likely route of exposure.
Injury from detonation	Seek prompt medical attention.

SPILL OR LEAK PROCEDURES	
Spill/leak response	Use appropriate personal protective equipment. Isolate area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Only competent, experienced persons should be involved in cleanup procedures. Sweep up with non-sparking tools and remove.
Waste disposal	Dispose of in compliance with federal regulations under the authority of the *Resource Conservation and Recovery Act* (40 CFR Parts 260-271).

SPECIAL PROTECTION INFORMATION	
Ventilation	Use only with adequate ventilation.
Respiratory	NIOSH approved particle masks for dust and mist.
Eye	Safety glasses or goggles.
Gloves	Impervious rubber gloves.
Other	Cotton overalls, undergarments, and socks. Conductive soled shoes.

SPECIAL PRECAUTIONS
Keep away from friction, impact, and heat. Do not consume food, drink, or tobacco in areas where they may become contaminated with these materials.

STORAGE CONDITIONS
Store in accordance with the requirements of *Subpart K, ATF: Explosives Law and Regulations* (27 CFR 55.201-55.219).

SHIPPING INFORMATION		
Proper shipping name	Charges, shaped, flexible, linear	
Hazard class	1.1D	
UN Number	UN0288	
Proper shipping name	Charges, shaped	
Hazard class	1.1D, 1.4D, or 1.4S	
UN Number	1.1D	UN0059
	1.4D	UN0440
	1.4S	UN0441
Proper shipping name	Articles, explosives, n.o.s. (Casing cutter without Detonator Unassembled)	
Hazard class	1.4S, 1.4D, 1.1D	
UN Number	1.4S	UN0349
	1.4D	UN0352
	1.1D	UN0463
DOT Label & Placard	DOT Label	 1.1D Products  1.4D Products  1.4S Products
	DOT Placard	 1.1D Products  1.4D Products  1.4S Products ◂ **OR** ▸  1.4D/1.4S Products

The information contained in this Material Safety Data Sheet is based upon available data and believed to be correct; however, as such has been obtained from various sources, including the manufacturer and independent laboratories, it is given without warranty or representation that it is complete, accurate, and can be relied upon. *OWEN COMPLIANCE SERVICES, INC.* has not attempted to conceal in any manner the deleterious aspects of the product listed herein, but makes no warranty as to such. Further, *OWEN COMPLIANCE SERVICES, INC.* cannot anticipate nor control the many situations in which the product or this information may be used; there is no guarantee that the health and safety precautions suggested will be proper under all conditions. It is the sole responsibility of each user of the product to determine and comply with the requirements of all applicable laws and regulations regarding its use. This information is given solely for the purposes of safety to persons and property. Any other use of this information is expressly prohibited.

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MSDS prepared by:	David W. Boston	
	Original publication date:	09/13/93
	Revision date:	12/03/03

KINEPAK Liquid

Material Safety Data Sheet

5700 N. Portland, Suite 301 / Oklahoma City, OK 73112 / Phone: (405) 947-0765 / Fax: (405) 947-0768

SECTION 1 - PRODUCT INFORMATION

TRADE NAME:	KINEPAK Liquid
SYNONYM:	K1/3S, K1/2WP, K1S, K1BB, K1/2FS, K1P,
CHEMICAL FAMILY:	Nitromethane
FORMULA:	CH3 N02
CAS NUMBER:	None
UN/NA NUMBER:	UN 1261
DOT HAZARD CLASS:	3

SECTION 2 - HEALTH ALERT

DANGER - If misused or disposed of improperly, material could explode and cause death or serious injury.
DO NOT HANDLE WHEN IN DOUBT!!
See section VIII - Personal Protection
CHEM-TEL, INC. (800) 255-3924.

SECTION 3 - HEALTH HAZARD INFORMATION

EYE: May cause moderate irritation.
SKIN: May cause moderate irritation characterized my redness and pain.
INHALATION: Inhalation of decomposed products may irritate the respiratory tract. Prolonged exposure to these fumes may result in respiratory difficulties (shortness of breath, etc.) and possibly more severe toxic effects.
INGESTION: Swallowing large quantities may cause toxicity characterized by dizziness, bluish skin coloration, methemoglobinemia, unconsciousness, abdominal spasms, nausea, and pain.

SECTION 4 - EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT: Flush with large amounts of water. Seek medical aid.
SKIN CONTACT: Remove contaminated clothing. Wash skin thoroughly with soap and water.
INHALATION: Remove from exposure. If breathing stops or is difficult, administer artificial respiration or oxygen. Seek medical aid.
INGESTION: Give 1-2 large glasses of milk or water. Induce vomiting. Seek medical aid .

SECTION 5 - RECOMMENDED OCCUPATIONAL EXPOSURE LIMIT/ HAZARDOUS INGREDIENTS

EXPOSURE LIMIT (PRODUCT): None required for product.

HAZARDOUS INGREDIENTS:	PERCENT	EXPOSURE LIMIT	PPM	MG/M3
Nitromethane(ACG/H CAS No. 75-52-5)	Min.95-100%	ACG/H TWA		250

SECTION 6 - REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Heat (confinement); Stacking (burning), sparks.
INCOMPATIBILITY: Can react violently or explode, with reducing agents and organic materials. Avoid amines, strong alkalies & acids. ***HAZARDOUS REACTION / DECOMPOSITION PRODUCTS:*** At high temperatures, especially >374 F, may emit severe toxic fumes of nitrogen oxides.
CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION: Not applicable.

SECTION 7 - FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT & METHOD: 95 F, ***AUTO IGNITION TEMPERATURE:*** 784 F,
FLAMMABLE LIMITS (% BY VOLUME/AIR): LOWER: 7.3 at 33 C
EXTINGUISHING MEDIA: Water, Foam, CO2
FIRE-FIGHTING PROCEDURES: When explosive is burning, EVACUATE AREA. Avoid breathing vapor.
FIRE & EXPLOSION HAZARDS: Dangerous when exposed to heat or flame. Can support combustion of other materials involved in a fire and is capable of undergoing detonation if heated to high temperatures, especially under confinement including being piled on itself in a burning fire. When heated to decomposition, highly toxic fumes may be emitted. Do not return to area of explosion until smoke and fumes have dissipated. Dry alkali or amine salts are explosive.

KINEPAK Liquid

Material Safety Data Sheet

SECTION 8 - PERSONAL PROTECTION INFORMATION

EYE PROTECTION: Safety glasses approved for preventing eye contact.
SKIN PROTECTION: Neoprene, natural rubber, polyethylene or polyvinyl chloride gloves. Use barrier creams, hand protection and protective clothing.
RESPIRATORY PROTECTION: Not normally required. Mechanical filter or supplied air type respirator as required for concentrations exceeding the occupational exposure limit.
VENTILATION: Maintain adequate ventilation. Use local exhaust if needed.

SECTION 9 - PERSONAL HANDLING INSTRUCTIONS

HANDLING: Explosives should not be abandoned at any location for any reason. Do not handle during electrical storms.
STORAGE: Store in a cool, dry, well-ventilated area remote from operations. Storage area should be of non-combustible construction. Organic materials, flammable substances and finely divided metals should be stored separately. Flames, smoking and unauthorized personnel are prohibited where this product is used or stored. Protect against physical damage, static electricity and lighting.
WARNING: Use of this product by persons lacking adequate training, experience and supervision may result in death or serious injury. Obey all Federal, State, and local laws / regulations applicable to transportation, storage, handling, and use of flammable liquids and explosives.
DISTANCE: Always stay away from area of explosion or disposal sites. Stay behind suitable barriers.

SECTION 10 - SPILL & LEAK PROCEDURES

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED (IN ADDITION, SEE SECTION 8): Isolate area. Eliminate ALL sources of ignition. Avoid skin contact. Scrape up. Remove soiled clothing.
WASTE DISPOSAL - USE APPROPRIATE METHOD(S): Disposal of unexploded or deteriorated explosives material can be hazardous. Expert assistance is positively recommended in destroying explosives. Accidents can be prevented by thorough planning and handling in accordance with approved methods. Consult your supervisor, or the nearest SEC Regional Office for assistance. If improperly disposed of, material could explode and cause death or serious injury.
In all cases, follow facility emergency response procedures. Contact Facility Environmental Manager for assistance. Report any discharge of oil or hazardous substance that may enter surface waters to the National Response Center (800) 424 - 8802.

Observe all applicable local, state, and federal environmental spill and water quality regulations.

SECTION 11 - PHYSICAL DATA

BOILING POINT: 101°C (Nitromethane) ***MELTING POINT: -28.6 C%*** (Nitromethane)
VAPOR PRESSURE: 27.3 mm (mm Hg at 20 deg. C)
EVAPORATION RATE:(BUTYL ACETATE=100):1.39 ***VAPOR DENSITY (AIR=1):*** 2.1
VISCOSITY: NA ***SOLUBILITY IN WATER:*** Completely Soluble ***APPEARANCE/ ODOR:*** Colorless liquid

SECTION 12 - COMMENTS

This product is classified as a flammable liquid, ltd. Quantities and need not be stored in a high explosive magazine, except where required by local regulations. Storage should be in a well constructed, well ventilated, dry structure located to conform with local, state, and federal regulations.

Normal operating conditions are assumed unless otherwise stated. If any given information is not clear or does not apply to your situation, STOP, store the material suitably, and seek correct help from your supervisors, Institute of Makers of Explosives or **Slurry Explosive Corporation.** Disposal sites must be clear of people at the time of disposal.

NOTICE: The data and recommendations presented herein are based upon data which are considered to be accurate. However, Slurry makes no guarantee or warranty, either expressed or implied, of the accuracy or completeness of these data and recommendations.

KINEPAK SOLID

Material Safety Data Sheet

5700 N. Portland, Suite 301 / Oklahoma City, OK 73112 / Phone: (405) 947-0765 / Fax: (405) 947-0768

SECTION 1 - PRODUCT INFORMATION

TRADE NAME:	KINEPAK Solid
SYNONYM:	K1/3S,K1/2WP, K1S K1BB, K1/2FS, K1P,K2P,K4P
CHEMICAL FAMILY:	Nitrate
FORMULA:	NH4,NO3
CAS NUMBER:	6484-52-2
UN/NA NUMBER:	UN1942
DOT HAZARD CLASS:	5.1

SECTION 2 - HEALTH ALERT

DANGER - If misused or disposed of improperly, material could explode and cause death or serious injury.
DO NOT HANDLE WHEN IN DOUBT!!
See section VIII - Personal Protection
CHEM-TEL, INC. (800) 255-3924.

SECTION 3 - HEALTH HAZARD INFORMATION

EYE: Moderate irritant causing moderate initial pain.
SKIN: May cause moderate irritation characterized my redness and pain.
INHALATION: Inhalation of decomposed products may irritate the respiratory tract. Prolonged exposure to these fumes may result in respiratory difficulties (shortness of breath, etc.) and possibly more severe toxic effects.
INGESTION: Swallowing may cause toxicity characterized by dizziness, bluish skin coloration, methemoglobinemia, unconsciousness, abdominal spasms, nausea, and pain.

SECTION 4 - EMERGENCY AND FIRST AID PROCEDURES

EYE CONTACT:Flush with large amounts of water. Seek medical aid. ***SKIN CONTACT:*** Remove contaminated clothing. Wash skin thoroughly with soap and water. Seek Medical Aid Immediately. ***INHALATION:*** Remove from exposure. If breathing stops or is difficult, administer artificial respiration or oxygen. Seek medical aid.
INGESTION: Give 1 cup of water to dilute material. Do not induce vomiting. If spontaneous vomiting occurs, have victim lean forward with head down to avoid breathing in of vomitus, rinse mouth and administer more water. Seek medical aid IMMEDIATELY.

SECTION 5 - RECOMMENDED OCCUPATIONAL EXPOSURE LIMIT/ HAZARDOUS INGREDIENTS
EXPOSURE LIMIT (PRODUCT): None required for product.

HAZARDOUS INGREDIENTS:	PERCENT	EXPOSURE LIMIT	PPM	MG/M3
Ammonium Nitrate	99-100%	NONE		

SECTION 6 - REACTIVITY DATA

CONDITIONS CONTRIBUTING TO INSTABILITY: Heat (confinement); Stacking (burning). ***INCOMPATIBILITY:*** Avoid oxidizable materials, metal powder, copper, bronze, fuels (e.g. lubricants, machine oils),Fluorocarbon lubricants, acids, corrosive liquids, chlorates, sulphur, charcoal, coke and other finely divided combustibles.
HAZARDOUS REACTION / DECOMPOSITION PRODUCTS: Toxic gases and vapors (oxides of nitrogen) will be released by thermal decomposition (about 210° C). At higher temperatures, decomposition may be explosive, especially if confined. ***CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION:*** Not applicable.

SECTION 7 - FIRE AND EXPLOSION HAZARD INFORMATION

FLASH POINT & METHOD: NA ***AUTO IGNITION TEMPERATURE:*** Explodes
FLAMMABLE LIMITS (% BY VOLUME/AIR): LOWER: NA UPPER: NA ***EXTINGUISHING MEDIA:*** Water only
FIRE-FIGHTING PROCEDURES: Large quantities of water should be used to cool containers, cool and dilute the burning material. A water spray can also be used to knock down fumes ***FIRE & EXPLOSION HAZARDS:*** Attempts to smother a fire involving this product will be ineffective as it is its own oxygen source. Smothering could lead to decomposition and explosions. This product is more sensitive if contaminated with organics, or oxidizable materials or if heated while confined. Unless the mass of product on fire is flooded with water, re-ignition is possible.

KINEPAK SOLID

Material Safety Data Sheet

SECTION 8 - PERSONAL PROTECTION INFORMATION

EYE PROTECTION: Safety glasses approved for preventing eye contact.
SKIN PROTECTION: Neoprene, natural rubber, polyethylene or polyvinyl chloride gloves. Use barrier creams, hand protection and protective clothing.
RESPIRATORY PROTECTION: A NIOSH/MSHA- approved dust respirator, if concentrations in air are unknown or in excess of established exposure guidelines.
VENTILATION: Maintain adequate ventilation. Use of local exhaust required.

SECTION 9 - PERSONAL HANDLING INSTRUCTIONS

HANDLING: Explosives should not be abandoned at any location for any reason. Do not handle during electrical storms. ***STORAGE:*** Store in a cool, dry, well-ventilated area remote from operations. Storage area should be of non-combustible construction. Organic materials, flammable substances and finely divided metals should be stored separately. Flames, smoking and unauthorized personnel are prohibited where this product is used or stored. Protect against physical damage, static electricity and lightning.
WARNING: Use of this product by persons lacking adequate training, experience and supervision may result in death or serious injury. Obey all Federal, State, and local laws / regulations applicable to transportation, storage, handling, and use of explosives. ***DISTANCE:*** Always stay from area of explosion or disposal sites. Stay behind suitable barriers.

SECTION 10 - SPILL & LEAK PROCEDURES

PROCEDURES IF MATERIAL IS RELEASED OR SPILLED (IN ADDITION, SEE SECTION 8): Isolate area. Eliminate ALL sources of ignition. Avoid skin contact. Sweep up. Remove soiled clothing. Do not allow to enter sewers or watercourses.
WASTE DISPOSAL - USE APPROPRIATE METHOD(S): Disposal of unexploded or deteriorated explosives material can be hazardous. Expert assistance is positively recommended in destroying explosives. Accidents can be prevented by thorough planning and handling in accordance with approved methods. Consult your supervisor, or the nearest SEC Regional Office for assistance. If improperly disposed of, material could explode and cause death or serious injury.

In all cases, follow facility emergency response procedures. Contact Facility Environmental Manager for assistance. Report any discharge of oil or hazardous substance that may enter surface waters to the National Response Center (800) 424 - 8802.

Observe all applicable local, state, and federal environmental spill and water quality regulations.

SECTION 11 - PHYSICAL DATA

BOILING POINT: 210°C (410°) ***BULK DENSITY:*** 46-50lb/ft3: 0.77-0.82 g/cm3 ***VOLATILE BY VOLUME:*** NA ***MELTING POINT:*** 160 to 165°C (320 to 329°F) ***VAPOR PRESSURE:***(mm hg at 20°C):0 ***VISCOSITY:*** NA ***EVAPORATION RATE (ETHER=1):*** NA ***VAPOR DENSITY (AIR=1):*** NA ***SOLUBILITY IN WATER:*** 79% at 25°C (77°F) ***APPEARANCE/ ODOR:*** Free-flowing, hygroscopic, grey-white colored prills, Odorless.

SECTION 12 - COMMENTS

Storage should be in a well constructed, well ventilated, dry structure located to conform with local, state, and federal regulations.

Normal operating conditions are assumed unless otherwise stated. If any given information is not clear or does not apply to your situation, STOP, store the material suitably, and seek correct help from your supervisors, Institute of Makers of Explosives or Slurry Explosive Corporation. Disposal sites must be clear of people at the time of disposal.

NOTICE: The data and recommendations presented herein are based upon data which are considered to be accurate. However, Slurry makes no guarantee or warranty, either expressed or implied, of the accuracy or completeness of these data and recommendations.

DYNO
Dyno Nobel

MATERIAL SAFETY DATA SHEET
DYNO NOBEL INC.
2650 DECKER LAKE BOULEVARD, SUITE 300
SALT LAKE CITY, UTAH 84119
PHONE: 801-364-4800 FAX: 801-328-6452
E-MAIL: DNNA.HSE@AM.DYNONOBEL.COM
FOR 24 HOUR EMERGENCY CALL
CHEMTREC 800-424-9300 CANUTEC 613-996-6666

MSDS# 1121

DATE: 7/07/04

Supersedes MSDS
1121 08/01/03
EBCo ENSI122

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):

40 RDX NYLON LS
40 RDX NYLON RIBBON LS
80 RDX NYLON
80 RDX NYLON LS
80 RDX NYLON XHV LS
80 PETN Plastic
100 PETN Plastic
80 PYX LS
40 HMX NYLON LS
40 HMX NYLON RIBBON LS
50 HMX LOPRO NYLON LS
60 HMX NYLON LS
60 HMX HI-TEMP LOW PROFILE LS
60 HMX HI-TEMP LS
80 HMX NYLON LS
80 HMX HI-TEMP LS
80 HMX NYLON XHV LS

Product Class: Detonating Cord, Specialty (Oil Field)

Product Appearance & Odor: Flexible white or colored cord of woven textile with a protected explosive core of RDX (dyed pink), PETN, HMX (white crystalline powders) or PYX (yellow) and covered by a white or colored nylon, fluoro-copolymer or polyethylene plastic or textile jacket. No odor.

DOT Hazard Shipping Description: Cord, detonating 1.1D UN0065 II -or-
Cord, detonating 1.4D UN0289 II -or- Articles, explosive, n.o.s. (*explosive name*) 1.4S UN0349 II where the *explosive name* would be either RDX, HMX or PYX (spelled out)

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

		EXPOSURE LIMITS	
Ingredients	**CAS#**	**OSHA PEL**	**TLV-ACGIH**[2]
Pentaerythritol tetranitrate (PETN)	78-11-5	None[1]	None[2]
Cyclotrimethylene trinitramine (RDX)	121-82-4	None[1]	0.5 mg/m^3 (skin)
Cyclotetramethylene tetranitramine (HMX)	2691-41-0	None[1]	None[2]
2,6-Bis(picrylamino)-3,5-dinitropyridine (PYX)	38082-89-2	None[1]	None[2]
Ammonium Hydroxide	1336-21-6	None[1]	None[2]
Tributyl phosphate	126-73-8	5 mg/m^3	0.2 mg/m^3

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m^3 ; respirable fraction, 5 mg/m^3 .
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m^3 ; respirable particulate, 3 mg/m^3 .

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

* Core powder is predominantly one of the four explosive powders (PETN, RDX, HMX or PYX) with the possible trace amount of the other listed hazardous material. The approximate amount of explosive in a given grade of cord is expressed as that number of grains of explosive per linear foot of cord.
Example: 80 RDX NYLON contains about 80 grains RDX per foot of cord. (1 gram/meter = 4.7 grains/foot)

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable

Percent Volatile by Volume: Not Applicable

Melting Point: PETN decomposes at melting point, about 141°C
HMX decomposes violently at melting point, about 278°C
RDX decomposes at 190 – 200°C
PYX melts at 370°C

Vapor Pressure: Not Applicable **Vapor Density:** (Air = 1) Not Applicable **Solubility In Water:** Insoluble.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable **Flammable Limits:** Not Applicable

Extinguishing Media: (See Special Fire Fighting Procedures section.)

Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe, distant location. Allow fire to burn unless it can be fought remotely or with fixed extinguishing systems (sprinklers). For transportation fires involving large quantities of detonating cord, such as a trailer load, evacuate no less than 2,500 feet in all directions.

Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Buming or detonating material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

This is a packaged product that will not result in exposure to the explosive core material under normal conditions of use.

Eyes: May cause irritation, redness and tearing. PYX is a known eye irritant.

Skin: May cause irritation.

Ingestion: PETN is moderately toxic if ingested. See systemic effects below. HMX and RDX are poisonous by ingestion. See systemic effects below.

Inhalation: See systemic effects below.

Systemic or Other Effects: PETN is a known coronary vasodilator, and ingestion or inhalation may result in a lowering of blood pressure, headache or faintness, and a decreased tolerance for grain alcohol. Repeated over-exposure may result in chest pains in the absence of exposure. Systemic effects by ingestion include dermatitis.
Nitramines (RDX, HMX) are known sensitizers, meaning some people tend to become highly allergic over time to these materials, particularly if ingested or inhaled. Breathing RDX dust can cause spasms, nasal and respiratory irritation and cardiovascular collapse, and may affect the central nervous system and liver.
Carcinogenicity: No constituents are listed by NTP, IARC or OSHA.

Emergency and First Aid Procedures

Eye: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

Skin: Wash thoroughly with soap and water. If skin irritation occurs, seek medical attention.

Ingestion: Seek medical attention. Treat ingestion of RDX with gastric wash.

Inhalation: Remove to fresh air. If symptoms persist, seek medical attention.

Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.

Conditions to Avoid: Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.

Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis).

Hazardous Decomposition Products: Nitrogen Oxides (NO_X), Carbon Monoxide (CO)

Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate all personnel to a safe distant area and allow to burn or fight fire remotely. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If explosive powder is spilled from damaged detonating cord, remove all other explosives from the spill area. Wet down and clean spilled powder using a damp sponge or rag, avoid applying friction or pressure to the explosive, and place in a (Velostat) electrically conductive bag. Contamination of this material with sand, grit or dirt will render the material more sensitive to detonation. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.

Respiratory Protection: None normally required.

Protective Clothing: Work gloves and work clothing that reduce the possibility of skin abrasion and that would prevent contact with spilled explosive powder is suggested.

Eye Protection: Safety glasses or goggles are recommended.

Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State and local regulations. Only properly qualified and authorized personnel should handle and use explosives. Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.

Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.

Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
None		

DYNO NOBEL INC. Disclaimer
The information contained herein is provided for reference purposes only and is intended only for persons having relevant technical skills. Because conditions and manner of use are outside of our control, the user is responsible for determining the conditions of safe use of the product. While the information is believed to be correct, DYNO NOBEL INC. shall in no event be responsible for any damages whatsoever, directly or indirectly, resulting from the publication or use of or reliance upon the information contained herein. **(No warranty, either expressed or implied, of merchantability or fitness for a particular purpose, or of any nature with respect to the product, or to the information, is made herein.)**

DYNO
Dyno Nobel

MATERIAL SAFETY DATA SHEET
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FOR 24 HOUR EMERGENCY CALL 800-424-9300

MSDS# 1108

DATE: 01/24/05

Replaces MSDS 1108 05/09/03

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):
DYNO® Cast BOOSTERS - D10, D15, D25, D35, D45, D65, D90, D135
DYNO® Cast BOOSTERS – C30, C35, C40, C45, C90
DYNO® SLIDER BOOSTERS - DS35, DS45, DS90
DYNO® CORD SENSITIVE BOOSTERS - CS35, CS45, CS90, CS135
SEIS X®
DYNO® STINGER
DYNO AV100
Ballistic Disc 5.0

Product Class: Cast Booster

Product Appearance & Odor: Tan to brown solid with no odor. May also be silvery gray. Packaged in paper or plastic tube.

DOT Hazard Shipping Description: Booster 1.1D UN0042 II

NFPA Hazard Classification: Not Available (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	ACGIH TLV-TWA
Pentaerythritol Tetranitrate (PETN)	78-11-5	10-70	No Value Established
Trinitrotoluene	118-96-7	30-90	0.5 mg/m^3
RDX	121-82-4	0-55	No Value Established
HMX	2691-41-0	0-20	No Value Established

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Melting Point: 176° F (80° C) (TNT)

Vapor Pressure: 0.042mm Hg at 80° C (TNT)

Vapor Density: Not applicable

Density: 1.55 - 1.65 g/cc

Percent Volatile by Volume: Not applicable

Solubility in Water: < 0.01%

Evaporation Rate (Butyl Acetate = 1): Not applicable

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not applicable

Flammable Limits: Not applicable

Extinguishing Media: (See Special Fire Fighting Procedures section).

Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.

Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: Particulates in the eye may cause irritation, redness, and tearing. Prolonged or repeated contact may cause cataracts, optic neuritis, blurred vision or amblyopia.

Skin: Prolonged contact may cause irritation, severe eczema and sensitization dermatitis. TNT may be absorbed through the skin, which may be indicated by orange staining on exposed skin. See systemic effects below.

Ingestion: Harmful if swallowed. See systemic effects below.

Inhalation: Inhalation of dusts may cause irritation, sneezing or coughing. See systemic effects below.

Systemic or Other Effects: TNT is an irritant, neurotoxin, hepatotoxin, nephrotoxin and bone marrow depressant. Although exposure is unlikely, acute or chronic exposure may cause sensitization dermatitis, headache, dizziness, jaundice, lethargy, or problems with the liver or blood such as toxic nephritis, aplastic anemia, hemolytic anemia or methemoglobin formation. PETN is a known coronary vasodilator, and ingestion or inhalation may result in a lowering of blood pressure, headache or faintness, and a decreased tolerance for grain alcohol. Repeated over-exposure may result in chest pains in the absence of exposure.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

Skin: Remove contaminated clothing. Wash skin thoroughly with soap and water.

Ingestion: Seek medical attention.

Inhalation: In case of irritation, remove to fresh air. Seek medical attention if chronic symptoms occur.

Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.

Conditions to Avoid: Keep away from heat, flame, friction, impact, ignition sources and strong shock.

Materials to Avoid (Incompatibility): Corrosives (strong acids and bases or alkalis).

Hazardous Decomposition Products: Nitrogen Oxides (NO_X), Carbon Monoxide (CO)

Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.

Respiratory Protection: None normally required.

Protective Clothing: Non-permeable gloves and work clothing that reduce skin contact are recommended.

Eye Protection: Safety glasses are recommended.

Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry location. Store in compliance with all Federal, State and local regulations. Keep away from heat, flame, ignition sources or strong shock.

Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.

Other Precautions: It is recommended that users of explosives material be familiar with the Institute of Makers of Explosives Safety Library publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
None Applicable		

DYNO
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MSDS# 1108

DATE: 01/24/05

Replaces MSDS
1108 05/09/03

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): DYNO® Cast BOOSTERS - D10, D15, D25, D35, D45, D65, D90, D135
DYNO® Cast BOOSTERS – C30, C35, C40, C45, C90
DYNO® SLIDER BOOSTERS - DS35, DS45, DS90
DYNO® CORD SENSITIVE BOOSTERS - CS35, CS45, CS90, CS135
SEIS X®
DYNO® STINGER
DYNO AV100
Ballistic Disc 5.0

Product Class: Cast Booster

Product Appearance & Odor: Tan to brown solid with no odor. May also be silvery gray. Packaged in paper or plastic tube.

DOT Hazard Shipping Description: Booster 1.1D UN0042 II

NFPA Hazard Classification: Not Available (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	% (Range)	ACGIH TLV-TWA
Pentaerythritol Tetranitrate (PETN)	78-11-5	10-70	No Value Established
Trinitrotoluene	118-96-7	30-90	0.5 mg/m^3
RDX	121-82-4	0-55	No Value Established
HMX	2691-41-0	0-20	No Value Established

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Melting Point: 176° F (80° C) (TNT)

Vapor Density: Not applicable

Percent Volatile by Volume: Not applicable

Evaporation Rate (Butyl Acetate = 1): Not applicable

Vapor Pressure: 0.042mm Hg at 80° C (TNT)

Density: 1.55 - 1.65 g/cc

Solubility In Water: < 0.01%

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not applicable **Flammable Limits:** Not applicable

Extinguishing Media: (See Special Fire Fighting Procedures section).

Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.

Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: Particulates in the eye may cause irritation, redness, and tearing. Prolonged or repeated contact may cause cataracts, optic neuritis, blurred vision or amblyopia.

Skin: Prolonged contact may cause irritation, severe eczema and sensitization dermatitis. TNT may be absorbed through the skin, which may be indicated by orange staining on exposed skin. See systemic effects below.

Ingestion: Harmful if swallowed. See systemic effects below.

Inhalation: Inhalation of dusts may cause irritation, sneezing or coughing. See systemic effects below.

Systemic or Other Effects: TNT is an irritant, neurotoxin, hepatotoxin, nephrotoxin and bone marrow depressant. Although exposure is unlikely, acute or chronic exposure may cause sensitization dermatitis, headache, dizziness, jaundice, lethargy, or problems with the liver or blood such as toxic nephritis, aplastic anemia, hemolytic anemia or methemoglobin formation. PETN is a known coronary vasodilator, and ingestion or inhalation may result in a lowering of blood pressure, headache or faintness, and a decreased tolerance for grain alcohol. Repeated over-exposure may result in chest pains in the absence of exposure.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

Skin: Remove contaminated clothing. Wash skin thoroughly with soap and water.

Ingestion: Seek medical attention.

Inhalation: In case of irritation, remove to fresh air. Seek medical attention if chronic symptoms occur.

Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.

Conditions to Avoid: Keep away from heat, flame, friction, impact, ignition sources and strong shock.

Materials to Avoid (Incompatibility): Corrosives (strong acids and bases or alkalis).

Hazardous Decomposition Products: Nitrogen Oxides (NO_X), Carbon Monoxide (CO)

Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken In Case Material Is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.

Respiratory Protection: None normally required.

Protective Clothing: Non-permeable gloves and work clothing that reduce skin contact are recommended.

Eye Protection: Safety glasses are recommended.

Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry location. Store in compliance with all Federal, State and local regulations. Keep away from heat, flame, ignition sources or strong shock.

Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.

Other Precautions: It is recommended that users of explosives material be familiar with the Institute of Makers of Explosives Safety Library publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
None Applicable		

DYNO
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CHEMTREC 800-424-9300 CANUTEC 613-996-6666

MSDS# 1126

DATE: 01/24/05

Replaces MSDS
1126 10/20/03

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): PRIMALINE®
PRIMACORD®
PRIMASHEAR™
OPTICORD®
GEOSEIS®
LOW FLEX™
FIRELINE CORD

Product Class: Detonating Cord

Product Appearance & Odor: Flexible cord of woven textile with a protected explosive core of PETN (white crystalline powder) and covered by a white or colored plastic or textile jacket. May have a waxed finish. No odor.

DOT Hazard Shipping Description: Cord, Detonating 1.1D UN0065 II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

			Occupational Exposure Limits	
Ingredients	**CAS#**	**%**	**OSHA PEL-TWA**	**ACGIH TLV-TWA**
Pentaerythritol tetranitrate (PETN)	78-11-5	-----*	None[1]	None[2]

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m^3 ; respirable fraction, 5 mg/m^3.
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m^3 ; respirable part., 3 mg/m^3.

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

* Core powder is 100% PETN. The approximate amount of PETN in a given grade of cord is expressed as that number of grams of PETN per linear meter of cord. Range is from 1 to 280 gram/meter. Example: PRIMALINE® 5 contains approximately 5 grams PETN per meter of cord. (1 gram/meter = 4.7 grains/foot)

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable (PETN decomposes at melting point, about 141°C)

Vapor Pressure: Not Applicable

Vapor Density: (Air = 1) Not Applicable

Percent Volatile by Volume: Not Applicable

Solubility in Water: Insoluble.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Extinguishing Media: (See Special Fire Fighting Procedures section.)

Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe, distant location. Allow fire to burn unless it can be fought remotely or with fixed extinguishing systems (sprinklers). For transportation fires involving large quantities of detonating cord, such as a trailer load, evacuate no less than 2,500 feet in all directions.

Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning or detonating material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure
This is a packaged product that will not result in exposure to the explosive core material under normal conditions of use.

Eyes: May cause irritation, redness and tearing.

Skin: PETN is not known as a skin irritant or sensitizer.

Ingestion: PETN is moderately toxic if ingested. See systemic effects below.

Inhalation: See systemic effects below.

Systemic or Other Effects: PETN is a known coronary vasodilator, and ingestion or inhalation may result in a lowering of blood pressure, headache or faintness, and a decreased tolerance for grain alcohol. Repeated over-exposure may result in chest pains in the absence of exposure. Systemic effects by ingestion include dermatitis.

Carcinogenicity: No constituents are listed by NTP, IARC or OSHA.

Emergency and First Aid Procedures

Eye: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

Skin: Wash with soap and water.

Ingestion: Seek medical attention.

Inhalation: Remove to fresh air. If symptoms persist, seek medical attention.

Special Considerations: None.

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.

Conditions to Avoid: Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.

Materials to Avoid (Incompatibility): Corrosives (strong acids and strong bases or alkalis).

Hazardous Decomposition Products: Nitrogen Oxides (NO_X), Carbon Monoxide (CO)

Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate all personnel to a safe distant area and allow to burn or fight fire remotely. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If explosive powder is spilled from damaged detonating cord, remove all other explosives from the spill area. Wet down and clean spilled powder using a damp sponge or rag, avoid applying friction or pressure to the explosive, and place in a (Velostat) electrically conductive bag. Contamination of this material with sand, grit or dirt will render the material more sensitive to detonation. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.

Respiratory Protection: None normally required.

Protective Clothing: Work gloves and work clothing that reduce the possibility of skin abrasion and that would prevent contact with spilled explosive powder is suggested.

Eye Protection: Safety glasses or goggles are recommended.

Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State and local regulations. Only properly qualified and authorized personnel should handle and use explosives. Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.

Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.

Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	% By Weight
None		

African Explosives Limited

Product Safety Data Sheet

Conforms to 91/155/EEC and ISO 11014-1

Safety fuse - Durafuse, Stopefuse, Whitestar fuse

1 Identification of the substance / preparation and of the company / undertaking

Product name : Safety fuse - Durafuse, Stopefuse, Whitestar fuse
Product use : Narrow reef stoping and development applications.
Synonyms : Not available.
Chemical formula : Not applicable.

Supplied by : African Explosives Limited
PO Modderfontein, 1645.
Republic of South Africa

Emergency telephone number : **(+27 11) 608-3300.**

2 Composition/information on ingredients

Substance/preparation : Preparation

Chemical name* **Europe**	**CAS No.**	**%**	**EC number**	**Classification**
potassium nitrate	7757-79-1	10-30	231-818-8	O; R8 Xi; R36/38
sulfur	7704-34-9	5-15	231-722-6	F; R11 Xi; R36/37
See Section 16 for the full text of the R Phrases declared above				

The balance of the mass of this product is made up of inert plastics, natural fibres, charcoal, rheology modifiers and wetting agents

*** Occupational exposure limit(s), if available, are listed in section 8**

3 Hazards identification

The preparation is classified as dangerous according to Directive 1999/45/EC and its amendments.

Classification : E; R2
Additional hazards : After ignition. Dust and fumes may be harmful by inhalation on repeated exposure.
Effects and symptoms : Pre-use: Hazardous materials are encapsulated, no exposure during normal handling is therefore expected.
Post-use: Minimal exposure risk is expected as quantities of hazardous components used are small.
For more details on the toxicological properties of the hazardous components, see section 11.
Aggravating conditions : No additional remark.

See toxicological information (section 11)

4 First aid measures

First-aid measures

Inhalation : Pre-use: Hazardous materials are encapsulated, no exposure during normal handling is therefore expected.
Post-use: Minimal exposure risk is expected as quantities of hazardous components used are small.
For more details on the toxicological properties of the hazardous components, see section 11.

Ingestion	:	Not the normal route of entry.
Skin contact	:	Not the normal route of entry.
Eye contact	:	Not the normal route of entry.
Notes to physician	:	No specific treatment, treat symptomatically.
Protection of first-aiders	:	No additional information.

5 Fire-fighting measures

Extinguishing Media

Suitable	:	Do not fight fire.
Not suitable	:	No additional remark.
Unusual fire/explosion hazards	:	Explodes when heated.
Hazardous thermal decomposition products	:	These products are nitrogen oxides (NO, NO_2...), sulfur oxides (SO_2, SO_3...). Some metallic oxides.
Special fire-fighting procedures	:	When controlling fire before involvement of explosives, fire-fighters should wear positive pressure self-contained breathing apparatus (SCBA) and full turnout gear. Fire-fighters' protective clothing will provide limited protection. DO NOT FIGHT FIRE WHEN IT REACHES MATERIAL. Withdraw from fire and let it burn. Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. First move people out of line-of-sight of the scene and away from windows.
Protection of fire-fighters	:	No additional remark.

6 Accidental release measures

Personal precautions	:	Evacuate surrounding areas.
Environmental precautions and clean-up methods	:	Do not touch damaged container or spilled material. Do not clean-up or dispose except under supervision of a specialist. Call for assistance on disposal.

Note: see section 8 for personal protective equipment and section 13 for waste disposal.

7 Handling and storage

Handling	:	Keep locked up. Take precautionary measures against electrostatic discharges. Keep away from sources of ignition - No smoking. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label.
Storage	:	Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). See section 16 for specific regulations.

Packaging materials

Recommended use	:	Use original container.
Not suitable	:	No additional remark.

8 Exposure controls/personal protection

Engineering measures	:	Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.
Hygiene measures	:	Wash hands after handling compounds and before eating, smoking, using lavatory, and at the end of day.
Occupational exposure limits	:	

Ingredient name	Occupational exposure limits
No additional information.	

Recommended monitoring procedures	:	No additional information.

Personal protective equipment

Respiratory system	:	None required; however, use of adequate ventilation is good industrial practice.
Skin and body	:	No special protective clothing is required.
Hands	:	No special protective clothing is required.
Eyes	:	Safety glasses with side shields.

9 Physical and chemical properties

Physical state	: Plastic coated fuse which contains blackpowder and textiles. Colour coded as follows : > Durafuse - Green > Stopefuse 290 - Red > Whitestar fuse - White
Color	: Not applicable.
Odor	: Not applicable.
Odor threshold	: Not applicable.
Boiling point	: Not applicable.
Melting point	: Not applicable.
Density	: Not applicable.
Vapor density	: Not applicable.
Vapor pressure	: Not applicable.
Evaporation rate (butyl acetate = 1)	: Not applicable.
Solubility	: Not applicable.
Octanol/water partition coefficient	: Not applicable.
pH	: Not applicable.
Flash point	: Not available.
Fire hazards in presence of various substances	: Not applicable.
Auto-ignition temperature	: 230 C
Explosive properties	: Explosive in presence of open flames, sparks and static discharge, or shocks.
Lower explosion limit	: Not available.
Viscosity	: Not applicable.

10 Stability and reactivity

Stability	: The product is stable.
Conditions to avoid	: Heating may cause an explosion. shock
Materials to avoid	: None identified.
Hazardous Decomposition Products	: These products are nitrogen oxides (NO, NO_2...), sulfur oxides (SO_2, SO_3...). Some metallic oxides.
Hazardous polymerization	: Will not occur.

11 Toxicological information

Potential acute health effects

Eyes	: Hazardous ingredients : Hazardous in case of eye contact (irritant).
Skin	: Hazardous ingredients : Hazardous in case of skin contact (irritant). Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.
Inhalation	: Hazardous ingredients : Slightly hazardous in case of inhalation.
Ingestion	: Hazardous ingredients : May cause burns to mouth, throat and stomach.
Target organs	: No additional information.
Acute toxicity	:

Ingredient name	Test	Result	Route	Species
potassium nitrate	LD50	3750 mg/kg	Oral	Rat
	LD50	1901 mg/kg	Oral	Rabbit
sulfur	LDLo	175 mg/kg	Oral	Rabbit

Special remarks on toxicity to animals : No additional remark.

Specific effects :

Ingredient name	Carcinogenic effects	Mutagenic effects	Developmental toxicity	Impairs fertility
No evidence.				

Special remarks on chronic effects on humans	: No additional remark.
Special remarks on other toxic effects on humans	: No additional remark.

12 Ecological information

Ecotoxicity Data :

Ingredient name	Species	Period	Result
potassium nitrate	Poecilia reticulata (LC50)	96 hours	180 mg/l
	Poecilia reticulata (LC50)	96 hours	188 mg/l
	Poecilia reticulata (LC50)	96 hours	191 mg/l
	Poecilia reticulata (LC50)	96 hours	200 mg/l
sulfur	Daphnia magna (EC50)	48 hours	>5000 mg/l
	Lepomis macrochirus (LC50)	96 hours	<14 mg/l
	Lepomis macrochirus (LC50)	96 hours	>180 mg/l
	Oncorhynchus mykiss (LC50)	96 hours	>180 mg/l

Ecological information :

Mobility : Not available.

Soil/water partition coefficient (K_{oc}) : Not available.

Persistence/degradability : Not readily biodegradable.

Bioaccumulative potential : Not expected to bioaccumulate.

Ingredient name	Persistence/degradability						Bioaccumulative potential		
	BOD_5	COD	ThOD	Aquatic half-life	Photolysis	Biodegradability	$LogP_{ow}$	BCF	Potenti
No additional information.									

Remarks : May be harmful to the environment if released in large amounts.

13 Disposal considerations

Methods of disposal : Waste must be disposed of in accordance with federal, state and local environmental control regulations. Call for assistance on disposal. Disposal of this product should only be done by trained personnel.

Waste classification : Hazardous waste.

European waste catalogue (EWC) : Not available.

14 Transport information

International transport regulations

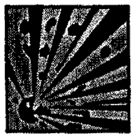
Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
ADR/RID Class	0105	FUSE, SAFETY	1.4S			**Limited quantity** **LQ0** **CEFIC Tremcard** **61S1897**
ADN Class	0105	FUSE, SAFETY	1.4S			-
IMDG Class	0105	FUSE, SAFETY	1.4S			**Emergency schedules (EmS)** **F-B, S-X** **Remarks** **Packaging Instructions: P140**
IATA-DGR Class	0105	FUSE, SAFETY	1.4S			**Packaging Instruction** **Passenger Aircraft** **Quantity limitation: 25 kg** **Packaging Instructions: 140** **Cargo Aircraft** **Quantity limitation: 100**

						kg **Packaging instructions: 140**

15 Regulatory information

EU Regulations

Hazard symbol(s) :



Explosive

Indication of Danger

Risk phrases : R2- Risk of explosion by shock, friction, fire or other sources of ignition.

Safety phrases : S16- Keep away from sources of ignition - No smoking.
S33- Take precautionary measures against static discharges.
S34- Avoid shock and friction.
S35- This material and its container must be disposed of in a safe way.

Product use : Classification and labeling have been performed according to EU directives 67/548/EEC, 1999/45/EC including amendments and the intended use.
- Industrial applications.

16 Other information

Full text of R-Phrases with no. appearing in Section 2 : R8- Contact with combustible material may cause fire.
R36/38- Irritating to eyes and skin.

Text of classifications appearing in Section 2 : O - Oxidizing
Xi - Irritant

Other special considerations : South African users should ensure that they comply with the Explosives Act, Act no. 26 of 1956 as amended. The material is classified as Class 6, Division 2, and Category X, Group 6A product. International users should comply with the Acts and Regulations as applicable in their respective countries.

History

Date of printing : **24/04/2004.**

Date of issue : **23/04/2004.**

Date of previous issue : **No Previous Validation.**

Prepared by : **AEL Technical Department.**

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Material Safety Data Sheet

Orica Brasil Ltda.
Avenida Industria Química Mantiqueira, 317 Lorena – São Paulo
Telephone: 0800-172505 or +55 12 553-3111

EMERGENCY CONTACTS FOR CHEMICAL EMERGENCIES (24 HOUR) INVOLVING TRANSPORTATION, SPILL, LEAK, RELEASE, FIRE, ACCIDENTS, LOST, STOLEN OR MISPLACED EXPLOSIVES: 0800-172505 or +55 12 553-3111

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: Powergel (Packaged Emulsion)
MSDS Number: 40060
Date Issued: 05-FEB-99
Product Use: A detonator-sensitive emulsion explosive.

SECTION 2 - COMPOSITION / INFORMATION ON INGREDIENTS

HAZARDOUS INGREDIENT(S) % (w/w) ACGIH TWA CAS NO.
Ammonium Nitrate 60-100 Not Listed. 6484-52-2
Sodium Nitrate 5-10 10 mg/m3. 7631-99-4
(nuisance dust)
Sodium Perchlorate 5-10 Not Listed. 7601-89-0
Aluminum 1-5 2 mg/m3 7429-90-5

SECTION 3 - HAZARDS IDENTIFICATION

Emergency Overview: Risk of explosion by shock, friction, fire or other sources of ignition. May cause skin irritation.
Irritating to eyes. May cause methemoglobinemia. May cause liver damage. May cause kidney damage. Read the entire MSDS for a more thorough evaluation of the hazards.

SECTION 4 - FIRST AID MEASURES

General: In case of accident or if you feel unwell, seek medical advice IMMEDIATELY (show the product label where possible).
Inhalation: Move victim to fresh air. Give artificial respiration ONLY if breathing has stopped. Give cardiopulmonary resuscitation (CPR) if there is no breathing AND no pulse. Obtain medical advice IMMEDIATELY.
Skin Contact: Wash affected areas thoroughly with soap and water. If irritation, redness, or a burning sensation develops and persists, obtain medical advice.
Eye Contact: Immediately flush eyes with running water for a minimum of 20 minutes. Hold eyelids open during flushing. If irritation persists, repeat flushing. Obtain medical attention IMMEDIATELY.
Ingestion: If victim is alert and not convulsing, rinse mouth out and give 200-300 mL (1 cup) of water to dilute material. DO NOT induce vomiting. Never give anything by mouth to an unconcious person. If spontaneous vomiting occurs, have victim lean forward with head positioned to avoid breathing in of vomitus, rinse mouth and administer more water. Obtain medical attention IMMEDIATELY.
Note to Physicians: Symptomatic. Administer oxygen if there are signs of cyanosis. If clinical condition deteriorates, administer 10 cc Methylene Blue intravenously. It is unlikely for this to be required with methemoglobin level of less than 40%.

SECTION 5 - FIRE-FIGHTING MEASURES

Flash Point: This product does not flash.
Flammable Limits (Lower): Not applicable.
Flammable Limits (Upper): Not applicable.
Auto Ignition Temperature: 230-265°C (446-509°F)
Decomposition Temperature: Ammonium nitrate will spontaneously decompose at 210 Deg. C.
Rate of Burning: Does not sustain burning at atmospheric pressure.
Explosive Power: 375 - 475 kJ/100 g.
Sensitivity to Mechanical Impact: Expected to be sensitive to mechanical impact.

Appearance: White to grey viscous liquid.
Odor: Odorless.
pH: Not available.
Vapor Pressure (mm Hg at 20°C): Negligible
Vapor Density (Air=1): Not available.
Boiling Point: Not applicable.
Melting Point: Not applicable.
Solubility (Water): Negligible.
Solubility (Other): Slightly soluble in organic solvents.
Specific Gravity: 1.14
Evaporation Rate: Not applicable.

SECTION 10 - STABILITY AND REACTIVITY

Hazardous Decomposition Products: Thermal decomposition products are toxic and may include hydrocarbons, oxides of carbon and nitrogen; hydrogen chloride and phosgene, in lesser amounts.
Chemical Stability: Stable at room temperature.
Conditions to Avoid: Keep away from heat, impact, and friction.
Incompatibility with other Substances: Avoid oxidizable materials, metal powder, bronze & other copper alloys, fuels (e.g. lubricants, machine oils), fluorocarbon lubricants, acids, corrosive liquids, chlorates, sulphur, sodium nitrite, charcoal, coke and other finely divided combustibles. Strong oxidizing and reducing agents.
Hazardous Polymerization: Will not occur.

SECTION 11 - TOXICOLOGICAL INFORMATION

Summary: May cause skin irritation. Irritating to eyes. May cause liver damage. May cause kidney damage. May cause methemoglobinemia.
TOXICOLOGICAL DATA:
PRODUCT: None established for product.
INGREDIENTS:
Ammonium Nitrate:
Oral LD50 (rat) = 2217 mg/kg
Dermal LD50 (rabbit) = 3000 mg/kg
Sodium Nitrate:
Oral LD50 (rat) = 1267 - 4300 mg/kg
Sodium Perchlorate:
Oral LD50 (rat) 2100 mg/kg
POTENTIAL HEALTH EFFECTS:
Inhalation: Inhalation is not a likely route of exposure at normally encountered temperatures and is thus not applicable. Combustion products may be irritating.
Skin Contact: May cause skin irritation.
Eye Contact: Moderate irritant causing moderate initial pain.
Ingestion: Highly unlikely under normal industrial use. Ingestion may cause irritation of the gastrointestinal tract.
Subchronic Effects: Signs and symptoms of kidney damage generally progress from oliguria, to blood in the urine, to total renal failure. Ingestion may cause methemoglobinemia. Initial manifestation of methemoglobinemia is cyanosis, characterized by navy blue lips, tongue and mucous membranes, with skin colour being slate grey. Further manifestation is characterized by headache, weakness, dyspnea, dizziness, stupor, respiratory distress and death due to anoxia. If ingested, nitrates may be reduced to nitrites by bacteria in the digestive tract. Signs and symptoms of nitrite poisoning include methemoglobinemia, nausea, dizziness, increased heart rate, hypotension, fainting and, possibly, shock.
Chronic Effects: Long-term overexposure to perchlorates may cause bone marrow damage. Some cases of aplastic anemia have been reported. Perchlorates suppress the uptake of iodine by the thyroid gland and can, in rare cases, cause goiter in chronically exposed workers. It is our belief that, under conditions of normal occupational exposure, this product should not pose such a hazard to the worker.
Carcinogenicity: The ingredients of this product are not classified as carcinogenic by ACGIH (American Conference of Governmental Industrial Hygienists) or IARC (International Agency for Research on Cancer), not regulated as carcinogens by OSHA (Occupational Safety and Health Administration), and not listed as carcinogens by NTP (National Toxicology Program).
Mutagenicity: There is no evidence of mutagenic potential.
Reproductive Effects: No information is available and no adverse reproductive effects are anticipated.

Sensitivity to Static Discharge: Not expected to be sensitive to static discharge.
Hazardous Reactions: None known.
Fire and Explosion Hazards: Explodes on overheating when contained and, thus, fires involving large quantities of the material should not be fought.
Extinguishing Media: See below.
Fire Fighting Procedures: DO NOT FIGHT FIRES INVOLVING EXPLOSIVE MATERIALS. Immediately evacuate all personnel from the area to a safe distance. Guard against re-entry.
Fire Fighting Protective Equipment: Use self-contained breathing apparatus and special protective clothing.
NOTE: Also see "Section 10 - Stability and Reactivity"

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Spills, Leaks, or Releases: Avoid the use of metal tools containing iron and/or copper. Be careful to avoid shock, friction, and contact with grit. Collect product for recovery or disposal. For release to land, contain discharge by constructing dykes or applying inert absorbent; for release to water, utilize damming and/or water diversion to minimize the spread of contamination. Collect contaminated soil and water, and absorbent for proper disposal. Notify applicable government authority if release is reportable or could adversely affect the environment.
Deactivating Chemicals: Detergents will break up emulsions if mixed in.

SECTION 7 - HANDLING AND STORAGE

Handling: This product is an explosive and should only be used under the supervision of trained personnel. The use of coveralls is recommended. Use normal good industrial hygiene and housekeeping practices.
Storage Requirements: Store under moderate temperatures recommended by a technical service representative. Store under dry conditions in a well ventilated magazine that has been approved for either detonator storage or explosive storage. Do NOT store explosives in a detonator magazine or detonators in an explosive magazine. Keep away from heat, sparks and flames. Keep containers closed. Explosives should be kept well away from initiating explosives; protected from physical damage; separated from oxidizing materials, combustibles, and sources of heat. Keep away from incompatibles.
Storage Temperature: Ideal storage temperature is 20-40 Deg. C. Do not expose sealed containers to temperatures above 40 Deg. C (104 Deg. F).

SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

PREVENTIVE MEASURES:
Recommendations listed in this section indicate the type of equipment which will provide protection against over exposure to this product. Conditions of use, adequacy of engineering or other control measures, and actual exposures will dictate the need for specific protective devices at your workplace.
Engineering Controls: General ventilation is recommended. Full handling precautions should be taken at all times.
PERSONAL PROTECTIVE EQUIPMENT:
Eye Protection: Use chemical safety goggles when there is potential for eye contact.
Skin Protection: Rubber gloves and protective clothing made from cotton should be impervious under normal conditions of use. User should verify impermeability under normal conditions of use prior to general use.
Respiratory Protection: A NIOSH/MSHA-approved respirator, if required.
EXPOSURE GUIDELINES:
PRODUCT: None established for product.
HAZARDOUS INGREDIENT(S):
Ammonium Nitrate:
Energetic Solutions Guideline 5 mg/m3 internal TWA
Sodium Nitrate:
ACGIH TLV 10 mg/m3 (nuisance dust)
Aluminum:
ACGIH TLV 2 mg/m3
OSHA PEL 2 mg/m3

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Alternate Name(s): Not available
Chemical Name: Not applicable.
Chemical Family: Emulsion packaged explosives.
Molecular Formula: Not applicable.

Teratogenicity and Fetotoxicity: No information is available and no adverse teratogenic/embryotoxic effects are anticipated.
Synergistic Materials: None known.

SECTION 12 - ECOLOGICAL INFORMATION

Ecotoxicological Information: Dissolves slowly in water. Harmful to aquatic life at low concentrations.
Environmental Effects: Can be dangerous if allowed to enter drinking water intakes. Do not contaminate domestic or irrigation water supplies, lakes, streams, ponds, or rivers.
Persistence and Degradation: Water-in soluble and remains explosive. With extended time periods, some ingredients will solubilize.

SECTION 13 - DISPOSAL CONSIDERATIONS

Burn under supervision of an expert at a government-approved explosive burning ground or destroy, by detonation in boreholes, in accordance with applicable local, provincial and federal regulations. Call upon the services of an Energetic Solutions Inc. Technical Representative.

SECTION 14 - TRANSPORT INFORMATION

Proper Shipping Name: Explosive, Blasting, Type E
Class/Division: 1.1D
Product Indentification Number (PIN): UN0241
Packing Group: II
Transportation Emergency Telephone Number: 1-800-424-9300.
DOT Class: Explosive, Blasting, Type E

SECTION 15 - REGULATORY INFORMATION

CANADIAN CLASSIFICATION:
This product has been classified in accordance with the hazard criteria of the CPR (Controlled Products Regulations) and this MSDS (Material Safety Data Sheet) contains all the information required by the CPR.
Controlled Products Regulations (WHMIS) Classification: This product is an explosive and is not regulated by WHMIS.
CEPA / Canadian Domestic Substances List (DSL): The substance(s) in this product is/are on the Canadian Domestic Substances List (CEPA DSL).
IARC Classification: None of the components of this product are listed on IARC.
USA CLASSIFICATION:
OSHA Classification:
Physical: Explosive. Oxidizer.
Health: Irritant.
Target Organ: Liver Eye. Skin. Respiratory tract. Liver. Urinary tract. Gastrointestinal tract. Blood/hematopoietic system. Endocrine system. Immune system.
SARA Regulations Sections 313 and 40 CFR 372: This product contains the following toxic chemical(s) subject to reporting requirements: Ammonium Nitrate (6484-52-2) Aluminum (7429-90-5)
Ozone Protection and 40 CFR 42: This product does not contain nor is it manufactured with ozone depleting substances.
Other Regulations/Legislation which apply to this product: Florida, New Jersey Special Health Hazard Substance List, Minnesota Hazardous Substance List, California Director's List of Hazardous Substances, New Jersey RTK Environmental Hazardous Substance, Rhode Island Hazardous Substance List, Massachusetts Right-to-Know, Pennsylvania Right-to-Know, New Jersey Right-to-Know.

SECTION 16 - OTHER INFORMATION

MATS Index: 59920
REFERENCES:
RTECS-Registry of Toxic Effects of Chemical Substances, CCINFOdisc, Canadian Centre for Occupational Health and Safety, National Institute for Occupational Safety and Health, U.S. Dept. of Health & Human Services, Cincinnati, 1998. Clayton, G.D. and Clayton, F.E., Eds., Patty's Industrial Hygiene and Toxicology, 3rd ed., Vol. IIA,B,C, John Wiley and Sons, New York, 1981. Supplier's Material Safety Data Sheets. CHEMINFO, HSDB, & NIOSH through "CCINFOdisc", Canadian Centre for Occupational Health and Safety, Hamilton, Ontario, Canada. 1998 "CHEMINFO", "CHRIS", "TDG","DOT", through "CCINFOdisc", Occupational Health and Safety, Hamilton,

Ontario, Canada. Documentation of the Threshold Limit Values and Biological Exposure Indices, 5th ed., American Conference of Governmental Industrial Hygienists Inc., Cincinnati, 1986. Threshold Limit Values and Biological Exposure Indices for 1997, American Conference of Governmental Industrial Hygienists, Cincinnati, 1997. Windholz, Martha, Ed., The Merck Index, 11th ed., Merck and Co., Inc., Rahway, New Jersey, 1989.

Prepared By: Safety, Health and Environment + 55 12 553-3111. The information contained herein is offered only as a guide to the handling of this specific material and has been prepared in good faith by technically knowledgeable personnel. It is not intended to be all-inclusive and the manner and conditions of use and handling may involve other and additional considerations. No warranty of any kind is given or implied and Orica Brasil Ltda. will not be liable for any damages, losses, injuries or consequential damages which may result from the use of or reliance on any information contained herein. This Material Safety Data Sheet is valid for three years from the date issued.

DYNO
Dyno Nobel

MATERIAL SAFETY DATA SHEET
DYNO NOBEL INC.
11TH FLOOR CROSSROADS TOWER
SALT LAKE CITY, UTAH 84144
PHONE: 801-364-4800 FAX: 801-328-6452
E-MAIL: DNNA.HSE@AM.DYNONOBEL.COM
FOR 24 HOUR EMERGENCY CALL 800-424-9300

MSDS# 1076

DATE: 01/22/03

Supersedes MSDS
1076 06/28/02

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s): ELECTRIC SUPER™ COAL
ELECTRIC SUPER™ LP
ELECTRIC SUPER™ SP
ELECTRIC SUPER™ SEISMIC
ELECTRIC SUPER™ STARTER
ELECTRIC SUPER™ INSTANT
TRONA

Product Class: Commercial Electric Detonators and Accessory Products

Product Appearance & Odor: Metal cylinder with varying length of attached plastic coated wires.

DOT Hazard Shipping Description: Detonators, Electric 1.1B UN0030 II
Or
Detonators, Electric 1.4B UN0255 II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients:	CAS#	MAXIMUM %	TLV-ACGIH
Tungsten	7440-33-7	0.47	5 mg/m^3
Barium Chromate	10294-40-3	1.2	0.1 mg (Cr_2O_3)/m^3
Lead Compounds	————	0.59	0.05 mg (Pb)/m^3
Pentaerythritol Tetranitrate (PETN)	78-11-5	3.7	No Value Established
Boron	7440-42-8	0.21	No Value Established
Potassium Perchlorate	7778-74-7	0.50	No Value Established
Diazodinitrophenol (DDNP)	4682-03-5	0.26	No Value Established
Nitrocellulose	9004-70-0	<0.1	No Value Established

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations.

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: Not Applicable
Percent Volatile by Volume: Not Applicable

Vapor Pressure: Not Applicable
Density: Not Applicable
Solubility in Water: Not Applicable

Amount of Lead in Detonator Product Line *				
Product	Pb compounds in detonator [grams]	Pb compounds in detonator [Wt.%]	Pb in detonator [grams]	Pb in detonator [Wt. %]
Electric Super SP	0.0412	0.588%	0.0357	0.5093%
Electric Super LP	0.0412	0.588%	0.0357	0.5093%
Electric Super Coal	0.0412	0.588%	0.0357	0.5093%
Electric Super Seismic	0.0000	0.0000%	0.0000	0.0000%

***Applies to only the detonator (source of lead). Do not use case weight or weight of any other component.**

DYNO NOBEL INC. Disclaimer

The information contained herein is provided for reference purposes only and is intended only for persons having relevant technical skills. Because conditions and manner of use are outside of our control, the user is responsible for determining the conditions of safe use of the product. While the information is believed to be correct, DYNO NOBEL INC. shall in no event be responsible for any damages whatsoever, directly or indirectly, resulting from the publication or use of or reliance upon the information contained herein. **(No warranty, either expressed or implied, of merchantability or fitness for a particular purpose, or of any nature with respect to the product, or to the information, is made herein.)**

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate area not less than 2,500 feet in all directions. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. Follow applicable Federal, State, and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: Not required for normal handling.

Respiratory Protection: None normally required.

Protective Clothing: Cotton clothing is suggested.

Eye Protection: Safety glasses are recommended.

Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Keep away from heat, flame, ignition sources, strong shock, and electrical impulses.

Precautions to be taken during use: Avoid breathing the fumes or gases from detonation of explosives. Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death.

Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

This product contains the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number (Use Toxic Chemical Category Code)	% By Weight
Barium Compounds	N040	1.2
Lead Compounds	N420	0 – 0.59
Chromium Compounds	N090	1.2

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable

Flammable Limits: Not Applicable

Extinguishing Media: None

Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe location, no less than 2,500 feet in all directions.

Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

Eyes: No exposure to chemical hazards anticipated with normal handling procedures. Particulates in the eye may cause irritation, redness and tearing.

Skin: No exposure to chemical hazards anticipated with normal handling procedures.

Ingestion: No exposure to chemical hazards anticipated with normal handling procedures.

Inhalation: Not a likely route of exposure.

Systemic or Other Effects: None known.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

Skin: Wash with soap and water.

Ingestion: Seek medical attention.

Inhalation: Not applicable.

Special Considerations: None

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact, especially when confined or in large quantities.

Conditions to Avoid: Keep away from heat, flame, ignition sources, strong shock and electrical impulse. Do not attempt to disassemble.

Materials to Avoid (Incompatibility): Corrosives (acids and bases)

Hazardous Decomposition Products: Carbon Monoxide (CO), Nitrous Oxides (NO_x), Lead (Pb) and various oxides and complex oxides of metals.

Hazardous Polymerization: Will not occur.

nitrochem

P.O. Box 681, 1 Brockchem Rd.
Maitland, On K0E 1P0
Tel: (613)348-3681
Fax: (613)348-3043

MATERIAL SAFETY DATA SHEET

SECTION I. MATERIAL IDENTIFICATION

UN#: 1942
CAS: 006 484 522

Emergency Telephone#: 613-348-3990
Canutec #: 613-996-6666
Chemtrec#:1 1-800-424-9300

NFPA/HMIS RATING: Health 2, Flammability 0, Reactivity 3
WHMIS Class 'C' Oxidizer

Manufacturer: **Nitrochem Corp**
Trade/Material Name: **Ammonium Nitrate - Industrial Grade**

Description: Solid granule,
Other Designations: AMMONIUM SALT
Chemical Formula: NH_4NO_3

SECTION II. INGREDIENTS AND HAZARDS

INGREDIENT NAME	HAZARD	PROVISIONAL LIMIT
AMMONIUM NITRATE	No TLV established No IDHL established Recommend Nuisance Rating (SAX) Respirable: 5 mg/m^3	Air 0.05 mg/m^3 Data by TRW Systems Group for EPA contract (August 1973, NTIS PB 244 591) LD_{50}: 5300 mg/kg LC_{50}: NOT AVAILABLE

COATING :(PRILLS WILL BE COATED WITH ONE OF THE THREE ANTICAKING AGENTS LISTED BELOW):

1. Clay - CAS NO:1332-58-7 : ≤1.0% — Respiratory Nuisance

2. Galoryl ATH - CAS NO: 57-11-4:
   - Mineral Oil - CAS NO: 67254-74-4:(<0.2% — No TWA established, TLV 5mg/M^3 suggested for oil mist

3. Hydrogenated Tallow Amine-CAS NO: 61788-45-2:
   - Hydrotreated Mineral Oil distillate - CAS NO: 64742-52-5:(<0.2%No TLV established

SECTION III. PHYSICAL DATA

Appearance and Odour

Solid odourless granule

Boiling Point:210°C (410°F)
Vapour Pressure:N.A.
Vapour Density:N.A.
Solubility, Cold water:118g/100g H_2O

Bulk Density:750-820 kg/m^3 (47-51 lb/cubic ft.)
Melting Point:169.6°C (336°F)
pH [0.1N Solution]:5.4
Molecular Weight:80.06

SECTION IV. FIRE AND EXPLOSION DATA

FLASH POINT	AUTOIGNITION TEMP.	FLAMMABILITY LIMITS IN AIR:
N/A	N/A	LOWER: N/A UPPER: N/A

EXTINGUISHING MEDIA

Use flooding amounts of water in early stages of fire. Keep upwind. This is an oxidizing agent which supports combustion and is an explosive hazard if heated under confinement that allows high pressure build-up. Upon heating, it gives off toxic gases of nitrogen oxides. Prevent contamination of NH_4NO_3 with other combustible materials that may cause possible explosion of the entire mass. Evacuate surrounding area of ammonia nitrate if sensitized with fuel and if adetonation is anticipated. Desensitize material with flooding amounts of water.

Firefighters should wear self-contained breathing apparatus.

SECTION V. REACTIVITY DATA

NH_4NO_3 is stable when stored and used under proper conditions. It is hygroscopic. Strong oxidizing agent. Reacts with strong alkalies to liberate ammonia.

Conditions to Avoid

Avoid unintentional contact with diesel oil. Many powdered metals react violently or explosively with fused NH_4NO_3 below 200C (392F) as follows: Al, Sb, Bi, Cd, Cr, Co, Cu, Fe, Pb, Mg, Mn, Ni, Sn, Zn, and brass. When contaminated with oil, harcoal, or other organic substances or flammable liquids can be considered an explosive, capable of detonation by combustion when confined or by shock from adjacent explosions. Sensitivity to detonation increases when heated (particularly dangerous if confined). The effect of various impurities on the thermal stability of solid NH_4NO_3 has been examined. [Ubanski, chem 1/2 Tech of Explosives. 1965 vol.2]

SECTION VI. HEALTH HAZARD INFORMATION

SUMMARY OF RISKS

Contact with skin may cause mild skin irritations. Individuals may be exposed to nitrogen oxides due to decomposition of NH_4NO_3 at high temperatures. This is a toxic gas which can quickly cause acute respiratory problems.

Use NIOSH/MSHA approved respirator/ total dust respirator when handling clay coated prills.

FIRST AID

Eye Contact:	Immediately flush with tempered running water. Get medical attention.
Skin Contact:	Flush with tempered water. Wash immediately with soap and water. Get medical attention.
Inhalation:	Remove to fresh air. Restore and/or support breathing as needed.
Ingestion:	Seek immediate medical attention.

This product is not known as a carcinogen. Toxic hazard rating (SAX)

TOXICITY

Acute Local:	Slight irritant, allergen, inhalation
Acute Systemic:	No information
Chronic Local:	Slight irritant, allergen, inhalation
Chronic Systemic:	No information
Reproductive Toxicity:	N/A
Mutagenicity:	N/A
Teratogenicity:	N/A
Toxicologically:	LD_{50}: 5300 mg/kg
	LC_{50}: NOT AVAILABLE
Synergistic Products:	N/A

SECTION VII. SPILL, LEAK AND DISPOSAL PROCEDURES

Report all spills immediately. Remove sources of heat or ignition. Sweep spill into a non-combustible container.

Disposal - For discharge follow Federal, Provincial, State or Municipal Regulations.

Aquatic Toxicity Rating:	TLm 96, over 1000-100 ppm
Provisional Limit:	Water and Soil 45 mg/1 (as NO_3)

SECTION VIII. SPECIAL PROTECTION INFORMATION

Provide general exhaust ventilation in the workplace and storage area.
A NIOSH/MHSA approved dust respirator should be available when the work situation warrants its use.
Wear rubber gloves and chemical goggles to minimize exposure and skin contact during handling.

SECTION IX. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION

Store in well-ventilated area with building made of noncombustible material equipped with automatic sprinkler system. Prevent entrapment of NH_4NO_3 by eliminating floor drains and depressions. Protect containers against Physical damage. Store separate from other chemicals and combustible materials.
[See code for storage of NH_4NO_3, NFPA 490 and 495]. Do not store above 54C (129F).
Store under dry conditions. A possible explosive hazard when contaminated with many other materials.

DOT: oxidizer
LABEL: oxidizer
DOT CLASS: OXIDIZER

ABBREVIATIONS

TC_{LO}: Lowest Published Toxic Concentration
LC_{LO}: Lowest Published Lethal Concentration
TWA: Time Weighted Average
TLV: Threshold Limit Value
LD_{50}: Lethal Dose 50
LC_{50}: Lethal Concentration 50
TLm: Median Tolerance Limit

SECTION X. PREPARATION INFORMATION

Contact Health/Safety Assistant, Nitrochem Corp. during business hours 08:00 to 16:00 EST. Phone 1-613-348-3681 extension 209.

NOTICE: The information presented herin is based on data considered to be accurate as of the date of preparation of this Material Safety Data Sheet. However, no warranty or representation expressed or implied, is made of the accuracy of the forgoing data and safety information.

Date: 2000-03-09

DYNO
Dyno Nobel

MATERIAL SAFETY DATA SHEET
DYNO NOBEL INC.
11[TH] FLOOR CROSSROADS TOWER
SALT LAKE CITY, UTAH 84144
PHONE: 801-364-4800 FAX: 801-328-6452
E-MAIL: DNNA.HSE@AM.DYNONOBEL.COM
FOR 24 HOUR EMERGENCY CALL
CHEMTREC 800-424-9300 CANUTEC 613-996-6666

MSDS# 1122

DATE: 10/20/03

Supersedes MSDS
1080 01/28/03
1107 01/22/03
1122 08/01/03
EBCo ENSI123

SECTION I - PRODUCT IDENTIFICATION

Trade Name(s):
NONEL® MS
NONEL® LP
NONEL® SL
NONEL® TD
NONEL® MS CONNECTOR
NONEL® TWINPLEX™
NONEL® STARTER
NONEL® EZ DET®
NONEL® EZTL™
NONEL® EZ DRIFTER ®
OPTIMIZER® OPTISLIDE®
OPTIMIZER® OPTISURFACE®
OPTIMIZER® OPTI-TL®

Product Class: Non-electric Detonators

Product Appearance & Odor: Aluminum cylindrical shell with varying length and diameter of attached colored plastic tubing. The detonator may be enclosed in a plastic housing, and an assembly may contain two detonators. Odorless.

DOT Hazard Shipping Description: Detonators, non-electric 1.1B UN0029 II -or- Detonator assemblies, non-electric 1.1B UN0360 II -or- Detonator assemblies, non-electric 1.4B UN0361 II

NFPA Hazard Classification: Not Applicable (See Section IV - Special Fire Fighting Procedures)

SECTION II - HAZARDOUS INGREDIENTS

Ingredients	CAS#	EXPOSURE LIMITS OSHA PEL	TLV-ACGIH
Pentaerythritol Tetranitrate (PETN)	78-11-5	None[1]	None[2]
Lead Azide	13424-46-9	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Lead	7439-92-1	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Silicon	7440-21-3	15 mg / m^3 (total dust) 5 mg / m^3 (respirable fraction)	10 mg / m^3
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3
Red Lead (Lead tetroxide)	1314-41-6	0.05 mg (Pb)/m^3	0.05 mg (Pb)/m^3
Titanium dioxide	13463-67-7	15 mg/m^3	10 mg/m^3
Barium Chromate	10294-40-3	1 mg (CrO_3)/10m^3 (ceiling) 0.5 mg (Ba)/m^3	0.01 mg (Cr)/m^3 0.5 mg (Ba)/m^3
Lead Chromate	7758-97-6	0.05 mg (Pb)/m^3 1 mg (CrO_3)/10m^3 (ceiling)	0.15 mg (Pb)/m^3 0.012 mg (Cr)/m^3
Barium Sulfate	7727-43-7	0.5 mg (Ba)/m^3	10 mg/m^3
Potassium Perchlorate	7778-74-7	None[1]	None[2]
Silica (crystalline)	61790-53-2	See Note Below	0.05 mg/m^3 (resp frac)
Molybdenum	7439-98-7	None[1]	None[2]
Tungsten	7440-33-7	None[1]	5 mg/m^3 (TWA) 10 mg/m^3 (STEL)
Aluminum	7429-90-5	15 mg/m^3 (total dust) 5 mg/m^3 (respirable fraction)	5 mg/m^3
Antimony	7440-36-0	0.5 mg/m^3	0.5 mg/m^3
Cyclotetramethylene Tetranitramine (HMX)	2691-41-0	None[1]	None[2]

[1] Use limit for particulates not otherwise regulated (PNOR): Total dust, 15 mg/m^3 ; respirable fraction, 5 mg/m^3 .
[2] Use limit for particulates not otherwise classified (PNOC): Inhalable particulate, 10 mg/m^3 ; respirable part., 3 mg/m^3 .
Note: The OSHA PEL for crystalline silica is calculated as follows:
Quartz, respirable: 10 mg/m$^{3\,e}$ / % SiO_2 + 2 Quartz, total dust: 30 mg/m^3 / % SiO_2 + 2

Ingredients, other than those mentioned above, as used in this product are not hazardous as defined under current Department of Labor regulations, or are present in deminimus concentrations (less than 0.1% for carcinogens, less than 1.0% for other hazardous materials).

SECTION III - PHYSICAL DATA

Boiling Point: Not Applicable
Vapor Density: Not Applicable
Percent Volatile by Volume: Not Applicable
Evaporation Rate (Butyl Acetate = 1): Not Applicable
Vapor Pressure: Not Applicable
Density: Not Applicable
Solubility in Water: Not Applicable

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not Applicable
Flammable Limits: Not Applicable

Extinguishing Media: (See Special Fire Fighting Procedures section.)

Special Fire Fighting Procedures: Do not attempt to fight fires involving explosive materials. Evacuate all personnel to a predetermined safe, distant location. Allow fire to burn unless it can be fought remotely or with fixed extinguishing systems (sprinklers).

Unusual Fire and Explosion Hazards: Can explode or detonate under fire conditions. Burning material may produce toxic vapors.

SECTION V - HEALTH HAZARD DATA

Effects of Overexposure

This is a packaged product that will not result in exposure to the explosive material under normal conditions of use. Exposure concerns are primarily with post-detonation reaction products.

Eyes: No exposure to chemical hazards anticipated with normal handling procedures. Particulates in the eye may cause irritation, redness, swelling, itching, pain and tearing.

Skin: No exposure to chemical hazards anticipated with normal handling procedures. Exposure to post-detonation reaction products may cause irritation.

Ingestion: No exposure to chemical hazards anticipated with normal handling procedures. Post-detonation reaction product residue is toxic by ingestion. Symptoms may include gastroenteritis with abdominal pain, nausea, vomiting and diarrhea. See systemic effects below.

Inhalation: Not a likely route of exposure. See systemic effects below.

Systemic or Other Effects: None anticipated with normal handling procedures. Repeated inhalation or ingestion of post-detonation reaction products may lead to systemic effects such as respiratory tract irritation, ringing of the ears, dizziness, elevated blood pressure, blurred vision and tremors. Heavy metal (lead) poisoning can occur.
Carcinogenicity: ACGIH classifies Lead as a "Suspected Human Carcinogen" and insoluble Chromium VI as "Confirmed Human Carcinogen". NTP, OSHA, and IARC consider components contained in this detonator carcinogenic.

Emergency and First Aid Procedures

Eyes: Irrigate with running water for at least fifteen minutes. If irritation persists, seek medical attention.

Skin: Wash with soap and water.

Ingestion: Seek medical attention.

Inhalation: Not applicable.

Special Considerations: None

SECTION VI - REACTIVITY DATA

Stability: Stable under normal conditions, may explode when subjected to fire, supersonic shock or high-energy projectile impact.

Conditions to Avoid: Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock. Do not attempt to disassemble.

Materials to Avoid (Incompatibility): Corrosives (acids and bases or alkalis).

Hazardous Decomposition Products: Carbon Monoxide (CO), Nitrous Oxides (NO_X), Sulfides, Chromates, Lead (Pb), Antimony (Sb) and various oxides and complex oxides of metals.

Hazardous Polymerization: Will not occur.

SECTION VII - SPILL OR LEAK PROCEDURES

Steps to be taken in Case Material is Released or Spilled: Protect from all ignition sources. In case of fire evacuate all personnel to a safe distant area and allow to burn or fight fire remotely. Notify authorities in accordance with emergency response procedures. Only personnel trained in emergency response should respond. If no fire danger is present, and product is undamaged and/or uncontaminated, repackage product in original packaging or other clean DOT approved container. Ensure that a complete account of product has been made and is verified. If loose explosive powder is spilled, such as from a broken detonator, only properly qualified and authorized personnel should be involved with handling and clean-up activities. Spilled explosive powder is extremely sensitive to initiation and may detonate. Follow applicable Federal, State, and local spill reporting requirements.

Waste Disposal Method: Disposal must comply with Federal, State and local regulations. If product becomes a waste, it is potentially regulated as a hazardous waste as defined under the Resource Conservation and Recovery Act (RCRA) 40 CFR, part 261. Review disposal requirements with a person knowledgeable with applicable environmental law (RCRA) before disposing of any explosive material.

SECTION VIII - SPECIAL PROTECTION INFORMATION

Ventilation: None required for normal handling. Provide enhanced ventilation after use if in underground mines or other enclosed areas.

Respiratory Protection: None required for normal handling.

Protective Clothing: Cotton gloves are recommended.

Eye Protection: Safety glasses are recommended.

Other Precautions Required: None.

SECTION IX - SPECIAL PRECAUTIONS

Precautions to be taken in handling and storage: Store in cool, dry, well-ventilated location. Store in compliance with Federal, State, and local regulations. Only properly qualified and authorized personnel should handle and use explosives. Keep away from heat, flame, ignition sources, impact, friction, electrostatic discharge and strong shock.

Precautions to be taken during use: Use accepted safe industry practices when using explosive materials. Unintended detonation of explosives or explosive devices can cause serious injury or death. Avoid breathing the fumes or gases from detonation of explosives. Detonation in confined or unventilated areas may result in exposure to hazardous fumes or oxygen deficiency.

Other Precautions: It is recommended that users of explosive materials be familiar with the Institute of Makers of Explosives Safety Library Publications.

SECTION X - SPECIAL INFORMATION

These products contain the following substances that are subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

Chemical Name	CAS Number	Max. lbs/1000 units
Lead	7439-92-1	39.4
	(Use Toxic Chemical Category Code)	
Lead Compounds	N420	2.0
Barium Compounds	N040	1.8
Chromium Compounds	N090	1.9

Range* of Section 313 Chemicals in each product

Product	lb Pb per 1000 detonators	lb Pb compounds per 1000 detonators	lb Ba compounds per 1000 detonators	lb Cr compounds per 1000 detonators
NONEL® MS	0 - 27	0.3 – 1.5	0	0
NONEL® LP	0 - 30	0.3 – 2.0	0 - 1.8	0 - 1.9
NONEL® SL	7 - 27	0.3 – 1.5	0	0
NONEL® TD	0 - 18	0.3 – 0.7	0	0
NONEL® MS Connector	5 - 16	0.3 – 0.4	0	0
NONEL® EZ DET®	22 - 36	2.0	0	0
NONEL® EZTL™	5 - 15	0.5 – 0.7	0	0
NONEL® EZ DRIFTER	39.4	1.3	1.2	1.3
NONEL® STARTER	0	0.3	0	0
NONEL® TWINPLEX™	5 - 15	0.3 – 0.7	0	0

*** The exact quantity and weight percent of Section 313 Chemicals in each delay period and wire length for each product is available upon request.**

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FINAL WORK PLAN
Non-Time-Critical Removal Action at the Municipality of Culebra, Puerto Rico

APPENDIX E

Munitions Constituents Sampling & Analysis Plan

(Field Sampling Plan • Quality Assurance Project Plan)

Prepared for

United States Army District, Jacksonville
United States Army Engineering and Support Center, Huntsville

Contract Number: W912DY-05-D-0007
Task Order Number: 0001
Project Number: I02PR006802

Prepared by

Ellis Environmental Group, LC
414 SW 140 Terrace, Newberry, FL 32669 • (352) 332-3888

January 2006

Part I

Field Sampling Plan

FINAL

Field Sampling Plan
Non-Time-Critical Removal Action
at the
Municipality of Culebra, PR

US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007, TO #0001

Independent Technical Review Certification

Responsibility Name	Company	Signature & Date
Author Kevin P. Hoyle, PG	EEG	23-JAN-06
Project Manager & Independent Technical Reviewer Mark G. Bagel, PG	EEG	23 JAN 06

Contents

Tables

Figures

Abbreviations & Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
ASR	Archives Search Report
CEHNC	United States Army Engineering and Support Center, Huntsville
DoD	Department of Defense
ECB	Environmental Chemistry Branch
EE/CA	Engineering Evaluation / Cost Analysis
EEG	Ellis Environmental Group, LC
ER	Engineer Regulation
FSP	Field Sampling Plan
FWS	Fish and Wildlife Service
GPS	global positioning system
HPLC	high-performance liquid chromatography
ID	identification
IDW	investigation-derived waste
LIMS	Laboratory Information Management System
MEC	munitions and explosives of concern
MS	matrix spike
MSD	matrix spike duplicate
NAD83	North American Datum of 1983
NG	nitroglycerin
OOU	ordnance operating unit
PE	professional engineer
PETN	pentaerythritol tetranitrate
PG	professional geologist
ppb	parts per billion
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SOW	Scope of Work
STL	Severn Trent Laboratories
TAL	Target Analyte List
USACE	United States Army Corps of Engineers
UTM	Universal Transverse Mercator
UXO	unexploded ordnance

1.0 Project Background

Ellis Environmental Group, LC (EEG), under Contract W912DY-05-D-0007 to the United States Army Engineering and Support Center, Huntsville (CEHNC), has been tasked with the collection and the analysis of pre-detonation and post-detonation soil samples for Target Analyte List (TAL) metals plus strontium by Methods 6010B/7471A, explosives by Method 8330, perchlorate by Method 314.0, plus pentaerythritol tetranitrate (PETN) and nitroglycerin (NG) by Method 8332M, at the former naval target range on Culebra Island and its surrounding cays. These sites include the Northwest Peninsula and Flamenco Beach (bombing and naval bombardment range), Cerro Balcon (mortar range), Isla Culebrita (strafing range and torpedo range), and Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza (all aerial bombardment sites).

1.1 Site History

Refer to Subchapter 1.1 of the Work Plan.

1.2 Site-Specific Definition of Problems

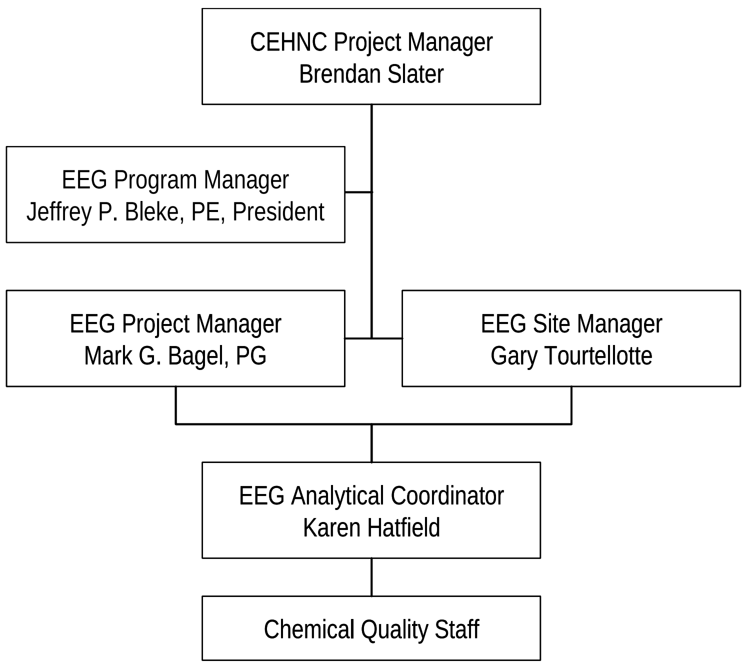
The Scope of Work (SOW) is to conduct a munitions and explosives of concern (MEC) removal action. The sampling will be conducted to determine if the demolition of MEC adversely impacts the soil quality in the site area.

2.0 Project Organization

2.1 Overall Project Organization and Responsibilities

2.1.01 EEG has established a project team of qualified personnel to provide oversight and quality control (QC) for this project. **Figure 2-1** shows the project organization that will control implementation of this Field Sampling Plan (FSP), and the following text describes responsibilities and chains of command.

Figure 2-1. Sampling Team Organization Chart



2.1.02 Brendan Slater is the CEHNC project manager. He is the technical representative of the CEHNC contracting officer and will be the primary point of contact during all phases of the project. He will review all contract deliverables, will be the primary point of contact for all project scope changes, and will manage the CEHNC technical team that is responsible for the review of all field change requests during the sampling effort.

2.1.03 Jeffrey P. Bleke, professional engineer (PE), is the EEG program manager. He is responsible for ensuring that contract requirements are being met on all task orders issued under this contract. He will not be involved with the daily project management except when a deficiency is noted by the CEHNC contracting officer or her representative.

2.1.04 Mark G. Bagel, professional geologist (PG), is the EEG project manager. He will be EEG's main point of contact for the client and the field teams and is responsible for overall project operations, scoping, scheduling, and budgeting. He will interface with the independent QC manager to ensure that all QC operations are being met, submit required reports, and resolve all non-conformance issues.

2.1.05 Gary Tourtellotte is the EEG site manager. He will perform daily inspections; ensure proper sample collection, handling, testing, and custody; provide daily reports to the project manager and the analytical coordinator; provide corrective actions for field deficiencies and ensure that they are instituted; complete field change requests; interface with the CEHNC project manager and support team; coordinate and direct the field effort; supervise field teams; coordinate with waste-disposal companies; assist with sample collection; provide daily safety checks; and complete accident and incident reports.

2.1.06 Either the project manager or the site manager will be on site during the sampling effort. When the site manager is not on site, the project manager will be responsible for completing the tasks to be performed by the site manager.

2.1.07 Karen Hatfield is the analytical coordinator. She will be the point of contact for the analytical laboratory and will review field and sample receipt reports and perform data validation.

2.2 Points of Contact

The following table provides point-of-contact information for this project.

Table 2-1. Points of Contact

Name	Position	Phone Number
Brendan Slater	CEHNC Project Manager	(256) 895-1507
Mark G. Bagel, PG	EEG Project Manager	(352) 333-2652
Rebecca Terry	CEHNC Project Chemist	(256) 895-1460
Laura Percifield	Quality Assurance Laboratory	(402) 444-4314
Karen Hatfield	EEG Analytical Coordinator	(352) 333-2681

3.0 Project Scope and Objectives

3.1 Task Description

3.1.01 EEG has been tasked with the sampling of surface soil in the detonation areas to determine the impact of the detonation of explosives on the chemical quality of the soils that exist at the former naval range. EEG will determine the existing conditions of the soils at the former range and the nature of explosive residue and metals after the detonation of MEC items at the range.

3.1.02 EEG will collect pre- and post-detonation composite samples at demolition sites where MEC is destroyed. A pre-detonation location is defined as any location immediately adjacent to where a demolition activity is about to be performed, and a post-detonation location is defined as any location where detonation of ordnance has been conducted within the past two months. The post-detonation sample will be collected only when the use of that demolition site is completed.

3.1.03 A total of 50 composite samples will be collected, which includes 10 percent blind replicates plus matrix spike (MS) and matrix spike duplicate (MSD) samples collected at a rate of 1 per 20 samples. (Greater than 50 or less than 50 samples may be analyzed depending on the number of unexploded items found and the number of remedial detonations required.) MS and MSD samples will be collected from the same container as the original sample and will not require separate sample jars. Equipment blanks will not be submitted, as EEG will use dedicated polypropylene scoops for sample collection and dedicated polypropylene mixing vessels for compositing soil samples.

3.1.04 EEG will use Severn Trent Laboratories (STL) Chicago as the environmental laboratory. STL Chicago has been approved previously for use on the Culebra project and has the proper United States Army Corps of Engineers (USACE) certifications. STL Chicago will supply a Puerto Rico-licensed chemist for sample data certification in accordance with Puerto Rico Environmental Quality Board requirements. Perchlorate samples will be shipped to STL Sacramento for analyses. STL Sacramento also has the proper USACE certifications.

3.1.05 Each pre- and post-detonation composite sample shall be analyzed for TAL metals plus strontium by Methods 6010B/7471A, and for explosives by Method 8330, plus PETN and NG by Method 8332M. Perchlorates will be analyzed using Method 314.0, with a detection limit of 40 parts per billion (ppb).

3.1.06 The sample analyses will include the QC samples as shown in **Table 3-1**.

Table 3-1. Sample Methods, Quantities, and Quality Control Samples

Analytical Group	Method	Depth	No. of Samples	Field Replicates	MS	MSD	Equipment Blanks	Total Samples
Explosives	8330	Surface	40	4	3	3	0	50
PETN, NG	8332M	Surface	40	4	3	3	0	50
Perchlorate	314.0	Surface	40	4	3	3	0	50
TAL metals plus strontium	6010B, 7471A	Surface	40	4	3	3	0	50

3.2 Site Access

United States Corps of Engineers Jacksonville District will provide right of entry for all locations of removal actions.

3.3 Project Schedule

Work is expected to begin by the end of February 2006.

4.0 Non-Measurement Data Acquisition

Non-measurement data acquisition describes those data needed from non-measurement sources. This may include information obtained from databases, literature, handbooks, local planning authorities, and other specific organizations. Information of this type may be needed to support risk assessment (local relevant or significant habitats, endangered species, future land uses, and well surveys), geological data (site bedrock formations, soil series), hydrogeological data (local or regional aquifers), meteorological data, and data supporting modeling activities.

4.1 Current Land Use

4.1.01 Ordnance operating unit (OOU) 3 is located in the east-central part of Culebra Island on the western slope of the hill named Cerro Balcon. The OOU encompasses approximately 30 acres and extends from the southern part of the San Isidro region of the island to the northern part of the Fraile region. The entire unit is privately owned and used primarily for grazing. Part of the unit is fenced. Access by the public is restricted by the landowner, poor roads, thick vegetation, and the fencing. At the time of the Engineering Evaluation / Cost Analysis (EE/CA) Action Memorandum, the future land use was to remain as grazing; however, present plans are for possible residential land development in this area. Houses have begun to be constructed atop the overlooking hills.

4.1.02 OOU-4 includes an 82-acre portion of the 266-acre Isla Culebrita, located east of Culebra Island. The island is currently administered by the United States Fish and Wildlife Service (FWS). Past use was minor recreation, and current use is recreation, including swimming, boating, and hiking. The island is accessible only by boat. Permission from FWS must be obtained before accessing the island. Approximately 21,000 people visit the island in a typical year. Several tour guides are permitted access to the island. The north bay of Isla Culebrita is a popular area for boaters and beach visitors. The island will remain under the administration of FWS and may be further developed with hiking trails.

4.1.03 OOU-5 consists of all the small cays that were identified by the Archives Search Report (ASR) as being part of the Culebra Island naval facility, including Cayo Botella, Cayo Alcarraza, Los Gemelos, Cayo Lobo, Cayo del Agua, Cayo Tiburon, and Cayos Geniqui. All of the islands have rugged terrain and limited beach areas. Most of the small cays are accessible only during calm seas and good weather. All of the cays are administered by FWS and require an entry permit. Access is currently limited to FWS personnel and will be similarly limited in the future.

4.2 Climate

Culebra Island has a tropical marine climate, with a year-round average daily temperature of 80 degrees Fahrenheit (°F). The average rainfall is 36 inches, and the average humidity is approximately 73 percent, with a daytime average of approximately 65 percent and a nighttime average of approximately 80 percent. The most humid months are August through January, although the humidity in the remaining months is only slightly lower. Prevailing winds are from the east-northeast for November through January and from the east for the rest of the year. Average wind speed is 8 knots. The hurricane season is from June through November, with most storms occurring July through September. Severe hurricanes occur through this area every 10 to 20 years.

4.3 Topography

4.3.01 Culebra Island (598 acres) has sandy beaches, irregular rugged coastlines, lagoons, coastal wetlands, steep mountains, and narrow valleys. Ninety percent of the island is mountainous, with population concentrations in the flatlands. The highest point on Culebra Island is Monte Resaca, which is approximately 630 feet above mean sea level. The island has a limited variety of soil types due to its volcanic origin, limited size, rugged terrain, and moderately uniform climate. Most soils, except along the slopes, are the result of weathering bedrock. The Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate. The surrounding cays exhibit similar topography.

4.3.02 The National Oceanic and Atmospheric Administration estimates that water depths average approximately 70 to 90 feet in the areas surrounding Culebra Island; however, some areas west of Flamenco Peninsula and east of Cayos Geniqui are more than 130 feet deep. Local maritime charts show “Caution UXO [unexploded ordnance]” in the northern and western areas. Tidal data for Culebra Island indicates that tides are chiefly diurnal. The height difference between mean higher high water and mean lower low water is 1.1 feet. The mean tide level is 0.6 foot.

4.4 Geology

4.4.01 Puerto Rico and its outlying islands are part of an island arc that largely consists of faulted and folded vulcaniclastic and sedimentary rock, locally intruded by igneous rock. These rocks range from Cretaceous to Eocene in age (USGS 1999).

4.4.02 Culebra and the adjacent cays are underlain by volcanic and intrusive rocks of Upper Cretaceous Age. Andesite lava and andesite tuff are clearly dominant. Toward the north-central part of Culebra and on eastern Cayo Luis Pena, the tuff and lava contain diorite porphyry inclusions. These volcanic rocks no longer exhibit porosity, due to compaction and the filling of pores with quartz and calcite (USACE-RI 1995).

4.4.03 The bedrock beneath most of Culebra is andesite lava and lava breccia. This material is generally overlain by a thin (generally 2 to 3 feet thick) layer of disturbed saprolite (USACE-RI 1995). In the area of the project sites, the ground surface has been impacted by the detonation of ordnance as part of Department of Defense (DoD) activities.

4.5 Hydrogeology

4.5.01 About a dozen natural springs and seeps exist on Culebra Island, but they are charged only after particularly wet seasons. Some wells 10 to 20 feet deep exist in areas away from coastal seepage, but these wells are high in chloride concentrations and salinity. As a result, most Culebra citizens get their fresh water from the desalinization plant installed by the Navy at the lower camp or from a potable-water pipeline that connects Culebra with the main island of Puerto Rico (USACE-RI 1995).

4.5.02 Due to the shallow bedrock and impermeability of the lava and overlying soil, the potential for use of groundwater as a potable domestic, municipal, or commercial water source is virtually nonexistent. No significant aquifers are on Culebra Island and the surrounding cays.

4.5.03 Surface water is also scarce, and creeks and streams are intermittent and seasonal. Normally they are dry and collect and drain runoff water only during rainstorms. Approximately 12 natural springs and seeps exist, but they are charged only during particularly wet seasons.

4.6 Soils

Soil is predominately a saprolite (weathered rock), and on average it extends to a maximum depth of approximately 4 feet. Most soils, except along the slopes, are the result of weathering bedrock.

The Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate. Igneous rock underlies the saprolite.

4.7 Cultural and Natural Resources

Cultural and natural resources are discussed in the Environmental Protection Plan (Chapter 11 of the Work Plan).

5.0 Field Activities

5.0.01 EEG will explosively destroy all MEC found during the removal action. When MEC is identified, a composite sample will be collected before and after destruction of the item. Each pre- and post-detonation sample will consist of six discrete grab samples (sub-samples) homogenized to form a composite sample.

5.0.02 MEC avoidance will be conducted at all sample locations by an UXO Technician II using a White's metal detector prior to sample collection. Pre-detonation samples will be collected at the closest distance to the item at which an anomaly is not detected. Post-detonation samples will be collected after the scrap is removed to ensure that no magnetic anomalies are in the sample area.

5.1 Field Procedures

5.1.1 Composite Surface Soil Sampling

5.1.1.01 Pre-detonation sub-samples will be collected immediately next to (within 1 foot) the MEC item or at the bottom of a demolition pit excavated specifically for demolition activities. The six sub-sample locations will be equidistant from each other within the 1-foot circumference of the MEC item or within the excavated area. Pre-detonation sub-samples will be collected just below the surface vegetation at a depth of approximately 1 inch to 2 inches.

5.1.1.02 Post-detonation sub-samples will be collected in the bottom of the crater created by the demolition operations. The six sub-sample locations will be equidistant from each other within the crater area. Care will be taken to ensure that metal fragments or sand from sandbags are not included in the sample. Post-detonation sub-samples will be collected from the soil surface to a depth of approximately 1 inch.

5.1.1.03 All vegetation and debris will be removed from the sub-sample location prior to sample collection. Each of the six sub-samples will be collected using a factory-sealed and clean polyethylene scoop dedicated to that one specific composite sample.

5.1.1.04 The sub-samples are placed into a factory-sealed and clean polyethylene mixing tray and divided into quarters. Each quarter is mixed separately, and then all quarters are mixed into the center of the tray. This procedure is repeated several times (a minimum of three repetitions) until the composite sample is adequately mixed and homogenized.

5.1.1.05 As the final step of mixing, the soil sample is arranged in a pile along the long axis of the mixing tray. The polyethylene scoop is moved across the entire width of the short axis of the pile to collect a swath of sample. Multiple evenly spaced swaths are collected until the pre-cleaned glass sample containers are full. Multiple containers are filled by rearranging the remaining material and collecting swaths as described. The glass containers will be carefully labeled and wrapped to prevent glass breakage. Samples containers will be placed in a cooler with bagged ice to keep the temperature of the samples at approximately 4 degrees Celsius (4°C).

5.1.2 Sampling Equipment

5.1.2.01 Required equipment for collection of soil samples includes:

- Nitrile gloves
- Coolers
- Ice
- Ziploc bags
- Pre-cleaned glass jars and lids
- Chain-of-custody forms
- Factory-sealed and clean polyethylene scoop
- Factory-sealed and clean polyethylene mixing tray
- Field notebook
- Sample labels
- Waterproof pen for labeling

5.1.2.02 Sample data, including sample name, location, sample time, sample type, sample description, and other appropriate data, will be recorded on the Surface Soil Sampling Form. A copy of this form is included in Appendix F of the Work Plan.

5.1.3 Sample Containers, Preservation, and Holding Times

5.1.3.01 The soil samples will be held on site for as short a time as reasonable. The samples must be maintained and received by the analytical laboratory at 4±2°C in a timely fashion so that the analysis can be conducted within holding time.

5.1.3.02 **Table 5-1** lists the recommended sample containers, preservation, and holding times for the analytical groups to be collected.

Table 5-1. Recommended Sample Containers, Preservation, and Holding Times

Parameter / Group	Container	Preservation[1]	Maximum Holding Time[2]	Minimum Volume[3]
METALS				
TAL metals plus strontium by 6010B/7471A	Glass, Teflon-lined cover	Cool, 4°C	14 days to extraction, 40 days to analysis after extraction	2 x 4 ounces
ORGANICS				
Explosives by 8330 (HPLC)	Glass, Teflon-lined cover	Cool, 4°C	14 days to extraction, 40 days to analysis after extraction	2 x 4 ounces
NG/PETN by 8332M (HPLC)	Glass, Teflon-lined cover	Cool, 4°C	14 days to extraction, 40 days to analysis after extraction	2 x 4 ounces
INORGANICS				
Perchlorate by 314.0	Glass, Teflon-lined cover	Cool, 4°C	14 days to extraction, 40 days to analysis after extraction	2 x 4 ounces

Notes:

1 = Sample preservation should be performed immediately upon collection. Samples may then be preserved by maintaining at 4°C.

2 = Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.

3 = Three times enough sample will be collected for MS/MSDs.

HPLC = High-performance liquid chromatography

5.2 Field Quality Control and Quality Assurance Samples

5.2.1 Equipment Blanks

Equipment blanks will not be collected, as the equipment will be pre-cleaned, pre-packaged, and dedicated to each individual sample site.

5.2.2 Quality Control Samples (Field Replicate Samples)

Field replicate samples will be collected at a rate of 10 percent of the total samples. Each pre- or post-detonation sample designated for a field replicate must be homogenized thoroughly and divided equally. The field replicates will be given false sample identification (ID) that will identify them as field replicate samples. The fact that a sample is a field replicate will be noted only on the Surface Soil Sampling Form and in the field notes.

5.2.3 Quality Assurance Samples

5.2.3.01 Quality assurance (QA) samples will be collected from 10 percent of the total quantity of samples. The QA samples will be collected from the location that is chosen for the field replicate sample, and the quantity of material collected shall be sufficient for three samples.

The first two portions shall be submitted to STL Chicago as the primary sample and the field replicate sample. The third portion shall be submitted to the QA laboratory as a split sample for analysis. QA samples shall be shipped by overnight delivery to the government laboratory at the following address:

United States Army Corps of Engineers
Environmental Chemistry Branch (ECB) Laboratory
Attn: Laura Percifield
420 South 18th St.
Omaha, NE 68102
Telephone (402) 444-4314

5.2.3.02 The QA samples shall be analyzed by the same methods used for the primary samples and shall be used to compare the primary and QA data. Sampling containers will be provided by STL Chicago for the QA samples. All QA sample handling and custody requirements will be similar to those that apply to the primary samples. EEG will provide the QA laboratory a minimum of two weeks notice that samples will be shipped.

5.2.3.03 The project ID Laboratory Information Management System (LIMS) number will be written onto the labels and chain-of-custody records for all QA samples shipped to the ECB Laboratory. The CEHNC project chemist will be contacted to acquire the LIMS number prior to sample collection. EEG will also obtain a copy of their United States Department of Agriculture soil permit, which must accompany the shipment of soil samples from overseas.

5.2.4 Matrix Spike and Matrix Spike Duplicate Samples

MS and MSD samples will be collected at a rate of 1 per 20 samples in accordance with the Quality Assurance Project Plan (QAPP) (Part II of this Sampling and Analysis Plan). The samples will be collected from the same sample locations from which the primary samples are collected but identified as described in Chapter 6.1.1 of this FSP.

5.2.5 Temperature Blanks

A 4-ounce or greater plastic container will be filled with tap water and shipped with each cooler to be a temperature blank. The temperature will be measured upon receipt of the sample from the laboratory and recorded on the chain-of-custody form and on the laboratory's sample receipt form. A copy of the chain-of-custody form is included in Attachment E of the QAPP.

5.3 Surveying

The EEG field team will survey the locations of the soil samples using a Trimble XRS global positioning system (GPS) corrected to the Coast Guard beacon to determine the coordinates of sampling points to within 1-meter accuracy. Coordinates will be in the Universal Transverse Mercator (UTM) Zone 20 North projection using the North American Datum of 1983 (NAD83).

6.0 Field Operations Documentation

This chapter provides a description of the procedures required for proper documentation of tasks during field operations.

6.1 Sample Identification

Samples collected during the field effort will be fully documented from their collection to their arrival in the laboratory. This documentation will be done in indelible ink. Samples will be uniquely numbered and identified on appropriate data log sheets, sample containers, and chain-of-custody forms. Upon arrival at the laboratory, the sample chain-of-custody form will be checked against the sample containers received.

6.1.1 Sample-Numbering System

6.1.1.01 A sample-numbering system will be used to identify each sample collected in the field by matrix and location. **Table 6-1** provides the nomenclature for identifying the sample location type and matrix.

Table 6-1. Sample Code Prefix

Code	Description
SS-###-PRE SS-###-POST	Pre- and post-detonation samples and field replicate sample; replicated – use a false sample ID number
SS-###-MS	Matrix spike
SS-###-MSD	Matrix spike duplicate
Key: SS = Surface soil ### = Sample location (e.g., 002) Replicate samples will be given a false sample ID.	

6.1.1.02 The sample prefix will be followed by the sample location number. For example, a pre-detonation soil sample collected from surface soil location number 7 will be labeled SS-007. The field duplicate ID will include a false soil sample location number. A false sample time will be used to further hide the source of the sample. This false data will be noted on all documentation to the laboratory, but will be identified in the field logs. The blind replicate ID will be annotated in the field logbook and the daily field reports only. MS and MSD samples obtained from the same sample jar as the original sample. The sample jar will include all three designations as the sample ID (i.e., SS-001-PRE, SS-001-MS, and SS-001-MSD).

6.1.2 Sample Data Forms

Sample data forms will be secured in a bound field data logbook as described in Subchapter 6.2.1.2 of this FSP. Sample data forms include the Surface Soil Sampling Form and the Chemical Quality Control Report. Copies of the data forms are included in Appendix F of the Work Plan.

6.2 Documentation

6.2.01 All aspects of the field effort will be documented to provide a traceable record of activities, including meetings, sample collection, installation, and other project-specific activities. The field notes must contain enough detail such that, at a later date, an individual (not part of the field team) could reproduce the entire field effort by reading through the field notes. All signatures and initials must be legible.

6.2.02 The documentation required by this project includes:

- Field logbooks
- Photographs
- Chemical Quality Control Reports

6.2.03 All field notes will be written in the logbook by the site manager either during or immediately following completion of an activity. Since different tasks may have different team leaders, the author will refer to himself by name or initials, but never in the first person.

6.2.04 Maps drawn in the field must be to scale or have dimensions or distances placed on the items. A north arrow must be placed on all maps and appropriate drawings, and locations on the maps should be relative to an identifiable fixed object in the field.

6.2.05 The cover of a field logbook must contain the following information:

- Project name
- Project number
- Summary of the tasks in the book (i.e., soil sampling)
- Sequential book number
- Start date
- End date

6.2.06 All time observations should be recorded using military time. The time that an activity occurs (e.g., sampling, equipment start, conversations, etc.) will be recorded in the field logbook.

6.2.1 Field Logbooks

Two types of field logbooks will be kept during this project: daily time logbooks and field data logbooks. Each sampling team will complete daily time logs and field data logs as each task is conducted.

6.2.1.1 Daily Time Logbooks

6.2.1.1.01 Daily time logs will be kept in a hardcover professionally bound surveyor's field book, record book, or composition notebook. The daily time log will be used to record activities or items such as meeting minutes, telephone conversations, weather changes, general site activities, site observations, QC notes, safety observations, conversations, and field orders and directions. Arrival times of any visitors, whether the visit is project- or non-project-related, must also be identified in the daily time logs. Each daily time log will have the day and date clearly marked at the top of the page, followed by ID of the field team. The records will follow chronologically with the time and description of the activity or item. The pages of the daily time logs must be consecutively numbered and bound so that they cannot be removed without damaging the notebook.

6.2.1.1.02 Field sampling team ID will include each team member's full name, initials, and responsibilities. References to the field team using first person (I, we) or third person (he, she, they) is not acceptable. All references to the field team members or on-site contacts must be recorded using full names or initials. Throughout the field notes, initials of people on site must be consistent with those previously recorded in the daily time log.

6.2.1.1.03 At the end of each day, EEG's site manager will sign and date the daily time log, and any empty space remaining on the page will be marked to prevent additional notes being recorded that day. If the site manager's signature is not legible, it must be accompanied by his printed name. The following day's time log will start on a new page.

6.2.1.2 Field Data Logbooks

6.2.1.2.01 Field data logbooks are bound compilations of field data sheets used to record field sampling data. Each field sampling activity will have its own formatted data sheet for the completion of that activity. All blanks on each data sheet must be completely filled out as appropriate.

6.2.1.2.02 Field data logbooks must be bound in a manner that will prevent them from coming apart in the field. The use of loose pages clamped together in a clipboard or bound with staples is not acceptable. Comb binding will be used to secure field data sheets on this project.

6.2.2 Chemical Quality Control Reports

A Chemical Quality Control Report form will be used to document each day's sampling activities. The report will include the personnel and equipment, safety inspections and activities, summary of the daily field sampling activities, summary of samples collected, summary of field discussions with client, visitor list, and other pertinent data.

6.2.3 Corrections to Documentation

Field documents should be written with indelible waterproof black ink. No erasures are permitted. If an incorrect entry is made, the data should be crossed out with a single strike mark, initialed, and dated, and the correct data entered. An effort must be made to make all field documents legible and concise.

7.0 Sample Packaging and Shipping Requirements

7.1 Sample Chain-of-Custody Form

7.1.01 A completed chain-of-custody form will accompany all the samples shipped to the laboratory for chemical analyses. The chain-of-custody form for the samples will be sealed in a Ziploc bag and taped to the inside of the shipping container. The shipping container is also sealed with two signed and dated custody seals.

7.1.02 The primary objective of sample chain of custody is to provide an accurately written, verifiable record that allows tracing of the samples from the moment they are collected to their receipt by the laboratory. The chain-of-custody form will contain:

- Project data, including project name and job number
- Sample information, including sample date, time, location, and the parameter analysis groups
- Sample custody log, including names of persons relinquishing and receiving the samples and the dates and times of their transfers

7.2 Sample Labels and Tags

Each individual sample will be identified with an ID label or tag that will be affixed to the sample container in a manner that will prevent it from coming off when the sample container is cold or wet. The information recorded on the label will include:

- Sample ID number
- Source or location of sample
- Date sample was obtained
- Time sample was collected
- Sampler’s initials

7.3 Sample Packing

The following procedure is used for packing samples for shipping.

- Drain plug on cooler will be taped shut inside and out.
- Large plastic bag is placed in cooler as liner.
- Individual sample container is wrapped in bubble wrap.
- Bubble-wrapped sample container is placed in small plastic bag.
- Bagged sample containers are placed upright in cooler.

- Bubble wrap or other packing material is placed between individual sample containers in cooler.
- Cooler is filled with enough ice to keep the temperature at 4°C ± 2°C during shipping and until arrival at laboratory; enough packing material will used so that individual sample jars are not insulated from the ice. (Note: Care must be taken to make sure jars are not touching each other to prevent breakage during shipment.)
- Cooler is closed and sealed with filament-style strapping tape or equivalent.
- At least two custody seals are placed across the hinge line (one on the front and one on the side of the cooler) in a manner that will indicate whether tampering of the cooler has taken place.
- Posted on all four sides of the cooler are “This Side Up” labels, and posted on two sides and on the top are “Fragile” labels.

7.4 Sample Shipment

The custody of the sample coolers will be relinquished to the STL service center in Puerto Rico, or directly to Federal Express for shipment to STL Chicago. A copy of the laboratory’s United States Department of Agriculture permit is required to be placed with the shipping documents and manifest for shipments of soil samples from Puerto Rico.

8.0 Investigation-Derived Waste

The only sampling-related investigation-derived waste (IDW) will be the scoops and sample-compositing trays. Excess soil will be removed from the scoops and trays before placing them in a plastic bag. The bag with the scoops and trays will be disposed of at the local landfill.

9.0 Field Assessment – Three-Phase Inspection Procedures

9.0.01 To ensure that quality is maintained throughout all phases of this sampling effort, a three-phase control process (Engineer Regulation [ER] 1180-1-6, Contracts Construction Quality Management; and USACE Unified Facilities Guide Specifications 01450A, Chemical Data Quality Control, and 01451A, Contractor Quality Control) is followed. Preparatory, initial, and follow-up QC phases are performed on site by an assigned EEG QC officer whether or not a government representative is present. The QC officer will summarize the activities of each QC phase in the Chemical Quality Control Report. Because of the small amount of sampling required for this project, the EEG-site manager will be responsible for sampling QC.

9.0.02 Subchapter 5.1, Field Procedures, describes the activities and lists the field equipment and supplies required during these phases.

9.1 Preparatory Phase

9.1.01 The EEG site manager, in conjunction with the sampling team, will conduct the preparatory phase meeting prior to sampling at the site. This includes a review of all work requirements, a discussion of all required material and equipment, an examination of sample location areas, and a discussion of all field activities. If new sampling personnel arrive on site during the work effort, the site manager will repeat the preparatory phase with these personnel prior to beginning work. All personnel will review in detail this FSP, prior to this meeting, and will participate in a discussion of all pertinent sections of this plan during the preparatory meeting.

9.1.02 It will be verified during the preparatory phase meeting that the following required items are on site:

- FSP
- Area maps
- Field logbooks and indelible ink pens
- Recommended Sample Containers, Preservation, and Holding Times (**Table 5-1**)
- Chemical Quality Control Report forms
- Chain-of-custody forms (see Attachment E of QAPP)
- Sample shipping documents
- Sampling equipment (listed in Subchapter 5.12)
- Personal protective equipment (PPE)

- Sample containers and labels
- Sample preservatives (i.e., ice)
- Sample coolers and sample packing materials
- IDW storage containers (e.g., plastic trash bags)

9.1.03 The sampling team will also demonstrate how each composite sample will be collected using the intended sampling equipment and following the sample-compositing procedures. The sample-numbering system, sample labeling, laboratory turnaround times, laboratory tracking system, and sample shipment documentation requirements will also be discussed.

9.2 Initial Phase

The initial phase inspection will be performed by the EEG site manager, who will oversee sampling activities and review the work for compliance with contract requirements. At minimum, this will include the following:

- Inspection of field notes to ensure that all pertinent data are recorded according to project requirements
- Inspection of individual sample labels and chain-of-custody forms for accuracy, completeness, and consistency
- Inspection of the packaging of the samples
- Ensuring that primary and QA samples are correctly matched and recorded in the field logbook and Chemical Quality Control Reports.

9.3 Follow-Up Phase

Follow-up phase inspections will be performed on an as-needed basis by the site manager to ensure continued compliance with project requirements until completion of that particular feature of work. General procedures and documentation will be periodically checked to ensure that they are complete, accurate, and consistently executed throughout the duration of the project. Inspections will also include a review of any field data. Soil sampling will be closely monitored to make sure that the samples are properly collected, composited, stored, packaged, and shipped.

10.0 Corrective Actions

10.1 Recognition of Problems

10.1.01 Problems requiring corrective actions may occur in the field, during sample shipment, or at the laboratory site. To ensure field data quality, the EEG site manager will audit daily sampling procedures as they are being performed at the job site. Sampling procedures that are observed will be reported in the Chemical Quality Control Report. Once samples are collected and shipped, the site manager will notify the EEG analytical coordinator with shipment tracking numbers, sample IDs, and other appropriate data.

10.1.02 The EEG analytical coordinator will track the shipment of samples and laboratory non-conformance memoranda. She will receive sample arrival notifications, sample quality reports, notification of holding time exceedances, and notifications of problems that may affect sample quality from the laboratory project manager. She will notify the EEG project manager of all non-conformance issues with regard to the laboratory. The EEG project manager will contact the CEHNC project manager to discuss the non-conformance issue.

10.2 Implementation of Corrective Actions

10.2.01 To the extent possible, EEG or its subcontracting laboratories will resolve all situations that require corrective action before data quality is compromised. Such corrective action does not require documentation in a formal non-conformance memorandum but may be addressed in the Chemical Quality Control Report.

10.2.02 Corrective actions that involve compromised field data will be implemented after a thorough review of the non-conformance by the EEG project manager, the EEG analytical coordinator, the EEG site manager, and the CEHNC safety specialist. The results of the review will be compiled and the corrective action will be noted on a Non-Conformance Report. Corrective actions will be performed by the appropriate field or laboratory personnel in accordance with the Non-Conformance Report.

10.3 Documentation and Verification

The EEG site manager or project manager will be responsible for ensuring that field procedures are followed properly. Any non-conformance issues that are not immediately corrected will be reported to the CEHNC safety specialist. These notifications will be presented on a Non-Conformance Report included with the Chemical Quality Control Report. The Non-Conformance

Report will be used to track a non-conformance issue through the corrective action stage and into the verification stage. A copy of a blank Non-Conformance Report is included with the field forms in Appendix F of the Work Plan. After completion of the non-conformance reporting process, the Non-Conformance Report, including the approval history, will be supplied to the CEHNC safety specialist.

10.4 Responsibilities

The EEG analytical coordinator will report all laboratory non-conformances to the CEHNC safety specialist. The notifications will be provided on a Non-Conformance Report and provided on an as-needed basis.

11.0 References

11.0.01 United States Army Corps of Engineers, Rock Island District (USACE-RI), 1995. Archives Search Report Findings for Culebra Island National Wildlife Refuge, Culebra Island, Puerto Rico, Project Number I02PR006802.

11.0.02 United States Geological Survey (USGS), 1999. Groundwater Atlas of the United States Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands; HA 730-N; Puerto Rico and the U.S. Virgin Islands Regional Summary. At URL: http://capp.water.usgs.gov/gwa/ch_n/N-PR_Vitext1.html.

11.1 Additional Sources

11.1.01 ASTM D6051-96 (Reapproved 2001). Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities.

11.1.02 Ellis Environmental Group, LC, 2001. *Final Work Plan, Construction Support, Culebra National Wildlife Refuge, Puerto Rico.* U.S. Army Corps of Engineers, Huntsville Center, Contract No. DACA 87-00-C-0001 (revised September 2001).

11.1.03 Federal Environmental Management Agency (FEMA), 2000. Project Impact Community (Culebra Island) Conducts Risk Assessment and Vulnerability. At URL: http://www.fema.gov/nwz00/culebra.htm (with maps and tables).

11.1.04 MTA, Inc., 1995. *Final Removal Reports. Interim Remedial Action, Culebra Island NWR, P.R. Remediation of Sites in the U.S. Virgin Islands and Puerto Rico.* Contract No. DACA 87-92-92-D-0147, Delivery Order 0002, Prepared by MTA, Inc., Huntsville, Alabama, November 15, 1995.

11.1.05 United States Army Corps of Engineers, Washington D.C., Engineering and Design – Requirements for the Preparation of Sampling and Analysis Plans, EM 200-1-3, 01 February 2001.

11.1.06 United States Environmental Protection Agency, 1993. *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA.*

Part II

Quality Assurance Project Plan

FINAL

Quality Assurance Project Plan
Non-Time-Critical Removal Action
at the
Municipality of Culebra, PR

US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007, TO #0001

Independent Technical Review Certification

Responsibility Name	Company	Signature & Date
Author Karen Hatfield	EEG	Karen Hatfield 1-16-06
Project Manager & Independent Technical Reviewer Mark G. Bagel, PG	EEG	Mark G Bagel 1-23-06

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Abbreviations & Acronyms

%R	percent recovery
°C	degrees Celsius
AA	atomic absorption
ADR	Analytical Data Review
AES	atomic emission spectroscopy
BS	Bachelor of Science
CB	calibration blank
CCB	continuing calibration blank
CCV	continuing calibration verification
CEHNC	United States Army Engineering and Support Center, Huntsville
CFR	Code of Federal Regulations
CVAA	cold-vapor atomic absorption
DoD	Department of Defense
DQO	data quality objectives
EDD	electronic data deliverable
EEG	Ellis Environmental Group, LC
EM	Engineer Manual
FSP	Field Sampling Plan
HMX	octahydro-1,3,5-tetranitro-1,3,5,7-tetrazocine
HPLC	high-performance liquid chromatography
HTRW	hazardous, toxic, and radioactive waste
IC	ion chromatography
ICB	initial calibration blank
ICAP	inductively coupled argon plasma
ICV	initial calibration verification
ID	identification
LCS	laboratory control sample
LIMS	Laboratory Information Management System
LQM	laboratory quality manual
MB	method blank
MEC	munitions and explosives of concern
MD	matrix duplicate
MDL	method detection limit
mL	milliliter
MS	matrix spike
MSA	Method of Standard Additions
MSD	matrix spike duplicate
NG	nitroglycerin

NIST	National Institute of Standards and Technology
nm	nanometer
PE	professional engineer
PETN	pentaerythritol tetranitrate
PG	professional geologist
ppb	parts per billion
PQL	practical quantitation limit
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SDR	Sample Discrepancy Report
SAP	Sampling and Analysis Plan
SOP	standard operating procedure
STL	Severn Trent Laboratories
USACE	United Stated Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

1.0 Introduction

1.0.01 Ellis Environmental Group, LC (EEG) has been contracted by the United States Army Engineering and Support Center, Huntsville (CEHNC) to conduct munitions removal and other munitions-related services on Culebra Island, Puerto Rico. This project includes the removal of munitions, and soil sampling and analyses for explosive compounds, metals, and perchlorate. This project is being conducted under Contract Number W912DY-05-D-0007.

1.0.02 The purpose of this Quality Assurance Project Plan (QAPP) is to define the laboratory requirements for the munitions and explosives of concern (MEC) removal action at Culebra Island and its surrounding cays, and it strives to be consistent with the EEG Field Sampling Plan (FSP) and the following referenced analytical methods:

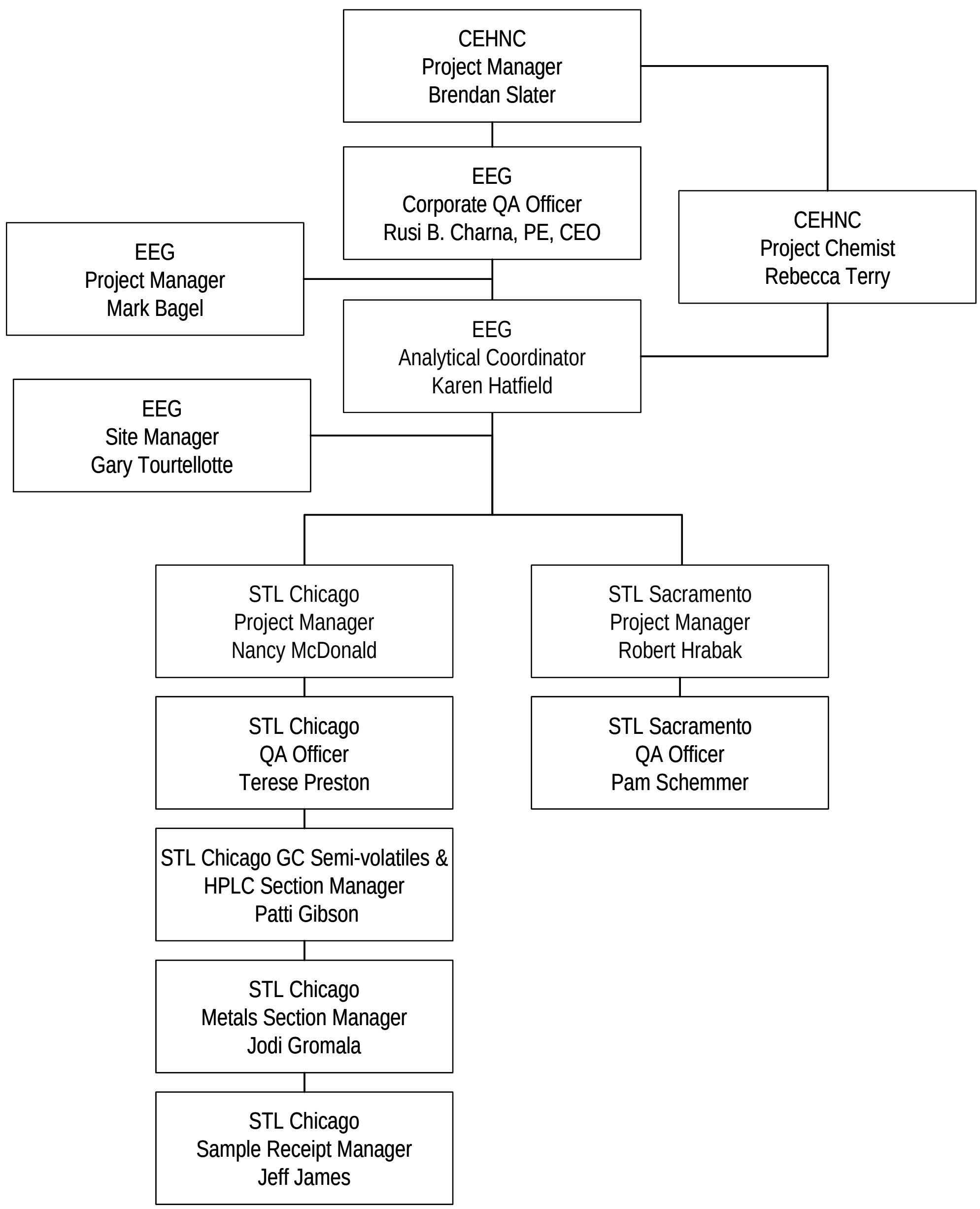
- 40 Code of Federal Regulations (CFR) Part 40, Appendix B
- Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories, Version 1, October 2000
- Test Methods for Evaluation of Solid Waste (SW-846) Update IIIA, Office of Solid Waste and Emergency Response, United States Environmental Protection Agency (USEPA), 1999
- USEPA Region 5, Resource Conservation and Recovery Act (RCRA) QAPP, April 1998
- USEPA QA/R-5, EPA Requirements for Quality Assurance Plans, March 2001
- United States Army Corps of Engineers (USACE) Shell – Part of Engineering and Design-Requirements for the Preparation of Sampling and Analysis Plans (EM [Engineer Manual] 200-1-3), February 2001
- Chemical Quality Assurance for Hazardous, Toxic, and Radioactive Waste (HTRW) Projects, EM 200-1-6, October 1997
- USACE Chemical Quality Management Procedures and Notifications (see Attachment A)

1.0.03 Adherence to the procedures described in this QAPP should ensure data that are scientifically sound, valid, defensible, and of known, acceptable, and documented quality.

2.0 Project Laboratory Organization and Responsibilities

This chapter gives an overview of the quality assurance (QA) organization for this project and the lines of communication among key personnel. Severn-Trent Laboratory (STL) Chicago is the project laboratory, with STL Sacramento to provide analysis for perchlorate. The organization chart in **Figure 2-1** shows key personnel, and the subchapters following provide brief descriptions of their responsibilities. Qualifications for key personnel are in Attachment B. Laboratory certifications held by STL are included in Attachment C.

Figure 2-1. Chemical Quality Organization Chart



2.1 Project Organization and Responsibilities

2.1.1 EEG Project Quality Assurance Officer

Rusi B. Charna, professional engineer (PE) and EEG's CEO, is an experienced chemical engineer with over 30 years in the environmental field. He holds a Bachelor of Science (BS) degree in chemical engineering and a BS degree in chemistry. He will be ultimately responsible for the chemical QA system for this project. He will perform appropriate checks on the chemical quality organization to ensure that the QA system is being implemented properly.

2.1.2 EEG Project Manager

Mark Bagel, professional geologist (PG), is the EEG project manager. He is ultimately responsible for the successful and timely completion of the project and is also responsible for:

- Allocating and directing resources
- Assigning technical staff
- Ensuring the completion of all quality control (QC) requirements by team members
- Supervising the document control process
- Approving all deliverables and associated documents prior to transmittal
- Establishing and maintaining communication between the technical staff, project managers, QA officer, health and safety coordinator, and regulatory agencies
- Implementing all programs and protocols related to the project

2.1.3 EEG Analytical Coordinator / Chemistry Quality Assurance / Project Chemist

Karen Hatfield is EEG's analytical coordinator. Her responsibilities include:

- Ensuring that the laboratory implements the requirements of the project Work Plan
- Coordinating with the laboratory on QA/QC matters
- Coordinating the review of laboratory data
- Coordinating data validation activities
- Providing updates to the project manager with regard to laboratory performance
- Documenting changes to this QAPP

2.1.4 STL Chicago Project Manager

Nancy McDonald is the STL Chicago project manager. She will serve as the primary contact person for EEG, and she will ensure that the laboratory meets the project requirements. She will coordinate sampling schedules between the laboratory and EEG, proactively communicate with

EEG, ensure laboratory adherence to contract and QAPP requirements, monitor the progress and timeliness of the work, review work orders and laboratory reports, and process any changes in the QAPP. Along with the laboratory QA officer, she will ensure that project-specific corrective action is taken to address problems identified by audits or QC results.

2.1.5 STL Chicago Quality Assurance Officer

Terese Preston is the STL Chicago project QA officer. She is responsible for the development and administration of this QAPP. This role includes preparation and review of written documents defining QC procedures, review and approval of laboratory QC procedures, and development and implementation of corrective actions.

2.1.6 STL Sacramento Project Manager

Robert Hrabak is the STL Sacramento project manager. He will ensure that the laboratory meets the project requirements for perchlorate analysis. He will also coordinate sampling schedules with the STL Chicago project manager, ensure laboratory adherence to contract and QAPP requirements, monitor the progress and timeliness of the work, review work orders and laboratory reports, and process any changes in the QAPP. Along with the laboratory QA officer, he will ensure that project-specific corrective action is taken to address problems identified by audits or QC results.

2.1.7 STL Sacramento Quality Assurance Officer

Pam Schemmer is the STL Sacramento project QA officer. She is responsible for the development and administration of this QAPP for perchlorate analysis. This role includes preparation and review of written documents defining QC procedures, review and approval of laboratory QC procedures, and development and implementation of corrective actions.

2.2 Key Personnel

Contact information for key personnel is provided in the **Table 2-1**.

Table 2-1. Points of Contact

Function	Name	Location	Telephone
Prime Contractor – EEG			
Project Manager	Mark Bagel, PG	414 SW 140th Terrace Newberry, FL 32669	(352) 332-3888
Corporate QA Officer	Rusi B. Charna, PE		
Site Manager	Gary Tourtellotte		
Project Chemist / Analytical Coordinator / Chemistry QA	Karen Hatfield		
Analytical Laboratory – STL Chicago			
Project Manager	Nancy McDonald	2417 Bond St. University Park, IL 60466-3182	(708) 534-5200
Project Manager – Backup	Eric Lang		
Project QA Officer	Terese Preston		
GC Semi-volatiles & HPLC Section Manager	Patti Gibson		
Metals Section Manager	Jodi Gromala		
Sample Receipt Manager	Jeff James		
Analytical Laboratory – STL Sacramento			
Project Manager	Robert Hrabak	880 Riverside Parkway West Sacramento, CA 95605	(916) 373-5600
Project QA Manager	Pam Schemmer		
Regulatory Agency			
Puerto Rico Department of Environmental Quality	Yarissa Martinez, Project Manager	PO Box 11488 San Juan, PR 00910-1498	(787) 767-8056
CEHNC Personnel			
Project Manager	Brendan Slater	US Army Engineering & Support Center Attn: CEHNC-CT-E 4820 University Square Huntsville, AL 35807	(256) 895-1507
Project Chemist	Rebecca Terry		(256) 895-1460
Environmental Chemistry Branch Laboratory			
QA Samples	Laura Percefield	420 S. 18th St. Omaha, NE 68102	(402) 444-4302

3.0 Data Assessment Organization and Responsibilities

The data assessment organization is shown on **Figure 2-1**. Data assessment is based on the review of the data quality indicators, laboratory operations documentation, and data validation. These activities will be performed by the laboratory project managers, the laboratory QA officers, the EEG analytical coordinator, and the CEHNC project chemist. Data assessment is discussed in detail in Chapters 8 and 9.

4.0 Data Quality Objectives

4.1 Data Use Background

The data from this project will determine if any residues from destruction of MEC have contaminated the surrounding soil.

4.2 Measurement Quality Objectives

Data quality objectives (DQOs) will be based on the analytical reporting limits, precision, accuracy, and completeness discussed in Chapter 7.

5.0 Sample Receipt, Handling, Custody and Holding Time Requirements

5.1 Verification / Documentation of Cooler Receipt Condition

5.1.01 Sample custody starts in the field as the samples are taken, but sample container custody records, in preparation of sampling, start at the bottle manufacturer and the laboratory. The integrity of the sample containers depends on the proper cleaning, preparation, storage, shipment, and documentation by the bottle manufacturer. The laboratory documentation of custody starts when cleaned and preservative-prepared sample containers are shipped to the field under custody. Successful sample custody is initiated by field personnel using traceable containers and relies on the fastidious completion of field custody protocols.

5.1.02 EEG will transfer the samples under chain of custody from Puerto Rico to STL Chicago. A copy of the chain of custody form will be kept by EEG. The sample shipping manifests will include a copy of the United States Department of Agriculture soil permit (see Attachment D) along with the manifest stating that these are soil samples for analytic purposes.

5.1.03 The sample custodian receives samples shipped or delivered to STL. The sample custodian inspects the shipping container and samples for integrity and custody seals. The samples are checked for breakage, leakage, damage, and preservatives. The Job Sample Receipt Checklist Report (Attachment E) is used to check sample receipt condition, including temperature. A temperature blank is used to measure the temperature inside the cooler. The contents of the shipping container are verified against the chain of custody documentation. The chain of custody form is in Attachment E. Documentation of custody seal integrity, temperature, and sample preservations are made on the Job Sample Receipt Checklist Report. Any problems are documented on the chain of custody or in a sample control communication form. The STL project manager will either resolve the problem internally or contact EEG’s analytical coordinator for resolution.

5.1.04 If the samples and documentation are acceptable, each sample is assigned a unique laboratory identification (ID) number from STL’s Laboratory Information Management System (LIMS). When the LIMS log has been completed, the samples are transferred to the appropriate refrigerators. Separate refrigerators are used for samples suspected to contain high levels of organic compounds and for samples receiving analysis for volatile compounds. The sample refrigerators are kept at 4±2 degrees Celsius (°C). The refrigerators storing samples for volatile analysis are monitored for contamination with refrigerator blanks.

5.1.05 Sample distribution is controlled and described in facility-specific standard operating procedures (SOPs). Thirty days after a final laboratory report has been generated and mailed to EEG, the samples are transferred from cold storage to the sample disposal area.

5.1.06 Holding times for samples are identified in the FSP.

5.2 Corrective Action for Incoming Samples

5.2.01 QC elements are used to monitor and assess the validity of sampling and analysis activities. Formal corrective actions (see Attachment F, SOP UQA-029) will be initiated in each subcontracted laboratory if data are determined to be of questionable validity, if QC elements are not within required limits, or if a performance trend develops. For routine problems, the analysts correct the problem and document such activity in the analytical run log or worksheet, and a formal corrective action report is not required.

5.2.02 Within each subcontracted laboratory, any employee aware of a problem related to one or more samples is responsible for initiating a Sample Discrepancy Report (SDR) (see Attachment F).

5.2.1 Internal Corrective Actions

Examples of QC elements generally monitored by each subcontractor laboratory are listed in Chapter 7 and Chapter 8. Other method-specific QC elements are also monitored during routine operations. See Attachment F for the corrective actions for each method.

5.2.2 External Corrective Actions

Any actions deemed necessary by EEG, CEHNC, or any other external regulatory or certifying agencies will be taken by the affected subcontractor laboratory as necessary. These actions are most likely to arise from a systems or performance audit, or from data review conducted by the agency.

5.2.3 Documentation

5.2.3.01 An SDR will be used by the subcontractor laboratories to document deficiencies and exceptions that may impact data quality, production, efficiency, or relations with STL or USACE.

To the extent possible, the laboratories will resolve all situations that require corrective action before data quality is compromised. These non-conformance actions do not require documentation in a formal SDR.

5.2.3.02 The following standards apply to corrective actions.

- The Job Sample Receipt Checklist Report (Attachment E) is a form of corrective action report. It documents problems encountered during sample receipt.
- If a critical problem requires immediate action in consultation with EEG (e.g., samples received after holding time expired, holding time missed during the analytical process, insufficient sample volume), the laboratory will notify EEG's analytical coordinator immediately and the corrective action designed in consultation with the USACE.
- If the laboratory reports data whose QC elements are not within criteria, the exceptions are noted in the case narrative.
- If the laboratory discovers any problems after the report has been sent to the client (e.g., after system or data audit, client inquiries, external review), a formal SDR will be initiated.

5.2.4 Sample Discrepancy Report Responsibility

5.2.4.01 SDRs are the responsibility of the laboratory staff. Any laboratory employee who becomes aware of a problem with any aspect of reported data is responsible for initiating an SDR. In most cases, this will be primarily the analyst's responsibility, but any reviewer or person in contact with the client that becomes aware of a problem must initiate a formal corrective action report.

5.2.4.02 The laboratory's project manager or point of contact as shown in Chapter 2 is responsible for reporting to the EEG analytical laboratory coordinator and to EEG's project chemist all corrective actions taken by the laboratory for this project. The laboratory project manager is responsible for ensuring that the action is implemented and documented in the case narrative. EEG's project chemist is responsible for reporting the action to EEG's project manager and to the USACE project chemist.

5.2.5 Sample Discrepancy Report Approval

SDRs are approved by the originating laboratory's project manager and QA officer, and completed SDRs are filed in the project file(s).

6.0 Analytical Procedures

6.1 Explosives Preparation and Analysis

6.1.1 Method 8330 – Explosives Residues by HPLC

6.1.1.01 Method 8330 provides high-performance liquid chromatography (HPLC) conditions for the detection of parts per billion (ppb) levels of certain explosives residues in water, soil, and sediment matrix. Prior to use of this method, appropriate sample preparation techniques must be used. These techniques are as follows.

6.1.1.02 Sample Homogenization: Soil samples are dried in air at room temperature or colder to a constant weight, taking care not to expose the samples to direct sunlight. The dried samples are ground and homogenized thoroughly in an acetonitrile-rinsed mortar to pass a 30-mesh sieve.

6.1.1.03 Explosives will be analyzed on the primary column and all positive results will be confirmed on the secondary column.

6.1.1.04 The laboratory will follow the SOP in Attachment F, which includes surrogates.

6.1.1.05 Low-Level Salting-Out Method With No Evaporation: Aqueous samples of low concentration are extracted by a salting-out extraction procedure with acetonitrile and sodium chloride. The small volume of acetonitrile that remains undissolved above the salt water is drawn off and transferred to a smaller volumetric flask. It is back-extracted by vigorous stirring with a specific volume of salt water. After equilibration, the phases are allowed to separate and the small volume of acetonitrile, residing in the narrow neck of the volumetric flask, is removed using a Pasteur pipette. The concentrated extract is diluted 1:1 with reagent grade water. An aliquot is separated on a C-18 reverse phase column, determined at 265 nanometers (nm), and confirmed on a CN reverse-phase column.

6.1.1.06 High-Level Direct-Injection Method: Aqueous samples of higher concentration can be diluted 1:1 volume:volume (v:v) with methanol or acetonitrile, filtered, separated on a C-18 reverse-phase column, determined at 254 nm, and confirmed on a CN reverse-phase column. If octahydro-1,3,5-tetranitro-1,3,5,7-tetrazoncine (HMX) is a target analyte, methanol is preferred.

6.1.1.07 Soil and sediment samples are extracted using acetonitrile in an ultrasonic bath, filtered, and analyzed by either the low level salting-out method or the high-level direct-injection method.

6.1.2 Method 8330M – NG and PETN by HPLC

Nitroglycerin (NG) and pentaerythritol tetranitrate (PETN) are analyzed as described in Method 8330, except the wavelength is 210 nm.

6.2 Metals Preparation Procedures and Analysis

Two techniques—inductively coupled argon plasma (ICAP) atomic emission spectroscopy (AES) and atomic absorption (AA) spectroscopy—will be employed to measure levels of specified metals in the samples. Sample digestion is required prior to most ICAP and AA analyses.

6.2.1 Method 3050A — Acid Digestion of Sediments, Sludges, and Solids

This digestion method is used to prepare sediment and soil samples for analysis by ICAP. A portion of the sample is digested with nitric acid. A final reflux procedure is performed using concentrated hydrochloric acid or concentrated nitric acid based on the SW 6010B method for ICAP. The final volume is adjusted to 50 milliliters (mL).

6.2.2 Method 6010B — Inductively Coupled Argon Plasma Procedures

6.2.2.01 Method 6010B is a procedure for determining elements in solutions using ICAP AES samples. Soils require digestion by Method 3050A prior to analysis.

6.2.2.02 Method 6010B provides a simultaneous multi-element determination by ICAP. Elements for this project are arsenic, barium, cadmium, chromium, lead, selenium, silver, aluminum, antimony, beryllium, calcium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, sodium, thallium, vanadium, zinc, and strontium. Samples are nebulized, and the resulting aerosol is transported to the plasma. Radio frequency ICAP produces element-specific atomic line emission spectra. The spectra are dispersed and the lines monitored by photo-multiplier tubes. The background will be measured and the results corrected for background levels.

6.2.3 Method 7471A — Mercury Procedure by Cold-Vapor Atomic Absorption

Method 7471A is the procedure for determining mercury in soil samples. Method 7471A is done by cold-vapor atomic absorption (CVAA) procedures for determining the concentration of mercury. Sample preparation is specified in the method. Following dissolution, mercury in the sample is reduced to the elemental state, separated from solution, and passed through a cell positioned in the light path of an AA spectrometer or mercury-specific analyzer.

6.2.4 Method EPA 314.0 (modified) — Perchlorate

6.2.4.01 A portion of homogenized sample is leached with deionized water for one hour, centrifuged, and filtered. A 1.0 mL volume of sample is introduced into an ion chromatograph. Perchlorate is separated and measured using a system comprised of an ion chromatograph pump, sample injection valve, guard column, analytical column, suppressor device, and conductivity detector.

6.2.4.02 The complete SOPs for the above methods are found in Attachment F.

6.3 Analytical Detection Limits

6.3.01 Various terms are used to express detection and reporting limits in environmental chemistry. The terms used for the work performed under this QAPP will be “method detection limit” (MDL) and “reporting limit.”

6.3.02 The MDL is an empirically derived value used to estimate the lowest concentration that a method can detect in a matrix-free environment. SW-846 defines the MDL as the minimum concentration of a substance that can be measured and reported with 99 percent confidence level and where the analyte concentration is greater than zero. The MDL is determined from the analysis of replicate samples of a given matrix containing analytes that have been processed through the preparation or extraction procedure. The guidance in 40 CFR 136, Appendix B, with additional laboratory-specific requirements, is used to produce MDL and is then annually updated by the laboratory. The latest values for the MDL are presented in Attachment G, and they may be updated during the course of the project as required by methods and regulatory agencies.

6.3.03 The reporting limit is a uniform reporting limit based on method practical quantitation limits (PQLs), actual performance at STL Chicago and STL Sacramento laboratories, and expected method performance in routine water and soil samples. The PQL is the lowest concentration that a method can reliably achieve within limits of precision and accuracy. Although the reporting limit is primarily based on the PQL, the reporting limit also evaluates empirical data for soil and water methods. The SW-846 PQLs often extrapolate soil PQL from water PQL, and they are not strictly based on the determinant method. Reporting limits are highly matrix-dependent. The latest values for the reporting limit are found in Attachment G.

6.4 Preventive Maintenance

6.4.01 The laboratory is equipped with sophisticated instrumentation needed to ensure successful completion of this project. A preventive maintenance schedule is in place in each laboratory to minimize instrument downtime and to obtain reliable data over the life of the instrument. Analysts and supervisors are primarily responsible for routine maintenance and repair of the instruments. Service agreements are kept for some major instruments in the each laboratory. Major repairs that go beyond the expertise of the analysts and supervisors are contracted to external specialists.

6.4.02 The preventive maintenance schedules are based primarily on manufacturer guidance, recommendations in the literature, and the experience of the analysts and supervisors. Some of the items will be performed as an integral part of each procedure (e.g., changing the injection port septum in gas chromatographs). Others will be followed as closely as possible, balancing to the extent possible the workload and the urgency of the need for preventive maintenance (e.g., clean and realign torch on ICAPs). Common sense and familiarity with the performance of each instrument will dictate whether the preventive maintenance schedule needs to be accelerated or delayed for that instrument. Trends and excursions from accepted limits for QC sample results are monitored to determine if there is instrument malfunction, and in such cases preventive maintenance is provided on an as-needed basis.

6.4.1 Routine Maintenance Activities

Preventive maintenance schedules for explosives and metals equipment are listed in **Table 6-1**.

Table 6-1. Preventive Maintenance for Laboratory Instruments

Instrument	Activity	Frequency
High-pressure liquid chromatograph	Check solvents in reservoirs	Daily
	Check gas supply	Daily
	Flush system with solvent to remove bubbles	Daily
	Pre-filter all samples	Daily
	Change pump seals when flow becomes inconsistent	As needed
	Change guard column	As needed
	Backflush column	As needed

Instrument	Activity	Frequency
Inductively coupled plasma atomic emission spectrometer	Check aspiration tubing	Daily
	Clean torch assembly	Monthly
	Clean spray chamber	Monthly
	Check gases	Daily
	Clean, lubricate pump rollers	As needed
	Check O-rings	Monthly
Cold-vapor atomic absorption spectrometerr	Check tubing	Daily
	Clean sparger	After each sample
	Clean windows	Monthly
	Change source lamp	As needed
Ion chromatograph	Inspect all itelium connections	Before each run
	Calibrate conductivity meter	Before each run
	Prime pump	Before each run

6.4.2 Contingency Plan

6.4.2.01 The laboratory has several pieces of analytical equipment in duplicate. This redundancy allows the laboratory to keep performing critical analyses on one instrument should the other be out of service.

6.4.2.02 In the event of instrument failure, or if critical holding times are approaching on a number of samples, these samples may be diverted to another laboratory, provided that they are properly certified for the project. This will be done in consultation with the USACE project chemist. When shipping samples to another laboratory, chain-of-custody procedures are maintained as described in Chapter 5.

6.4.2.03 As a further precaution, the laboratory keeps its major instrumentation connected to an uninterruptible power supply, which provides line conditioning and backup power.

6.4.3 Periodic Equipment Calibration

Balances are checked every day before the first use with a weight set traceable to Class S weights. Temperature in incubators, ovens, and refrigerators are monitored daily using thermometers that are calibrated against a National Institute of Standards and Technology (NIST)-traceable thermometer. All thermometers in use in the laboratory are verified for accuracy against an NIST-traceable thermometer at least every 12 months and when they are first placed into service. All mechanical pipettes and other devices used to deliver accurate volumes during the analytical process are verified every 12 months. **Table 6-2** presents a summary of calibration requirements for equipment that is used periodically.

Table 6-2. Periodic Equipment Calibrations

Type of Equipment	Calibration Requirements
Balances	Serviced and calibrated annually by an approved vendor. Calibration checked daily or before use by analyst with weight(s) classified as Class S by NIST or Class 1 traceable. Acceptance criteria vary according to weight used and accuracy of balance. Acceptance criteria are documented in the laboratory logbook. All Class 1 weights are certified by an outside vendor every 3 years. All non-Class 1 weights are checked annually against NIST Class 1 weights annually. Acceptance criteria is 1 percent for top-loading and 0.1 percent for analytical balances.
Thermometers	Working glass thermometers are calibrated against a certified NIST thermometer at least annually as described in operation-specific SOPs. Working non-glass thermometers are calibrated against a certified NIST thermometer at least annually as described in operation-specific SOPs. The NIST thermometer is re-certified every 3 years. Acceptance criteria is ±2°C.
Refrigerators / Freezers	Thermometers are immersed in a liquid such as mineral oil or glycerol for calibration and placed in all refrigerators and freezers.. Temperature of units used for sample or standard storage are checked daily as described in operation-specific SOPs. Refrigerator acceptance limits: 4±2°C; freezer acceptance limits: ±10°C.
Ovens	Temperature of units is checked daily or prior to use. Acceptance limits vary according to use as described in operation-specific SOPs and must be documented in the temperature logbook. Acceptance criteria is ±2°C.
Micropipettors	Calibrations are checked gravimetrically as required by the operation-specific SOP. Calibrated at the frequency (normally quarterly) required by the manufacturer at a minimum. Acceptance criteria is ±1 percent.
Syringes, Volumetric Glassware, and Graduated Glassware	Syringes and volumetric glassware are purchased as Class A. Class A items are certified by the manufacturer to be within ±1 percent of the measured volume; therefore, calibration of these items by the laboratories is not required. Analysts are trained in the proper use and maintenance of measuring devices to ensure the measurement of standards, reagents and sample volumes are within method tolerances. The accuracy of Class A volumetric glassware will be checked when first received at a rate of one per lot. Acceptance criteria is ±1 percent.

6.5 Calibration Procedures and Frequency

6.5.01 This subchapter discusses general requirements for instrument calibration, standard preparation, and traceability.

6.5.02 Instrument calibration is necessary for accurate sample quantitation. Calibrations establish the dynamic range of an instrument and response factors to be used for quantitation, and they demonstrate instrument sensitivity. Accurate sample quantitation also relies on accurate standards. Standard accuracy may be established by tracing the quantitation standard to a source of known and documented quality or by the comparison of standards from different sources. Instrument calibrations and standards are unambiguously documented so that the process of calibration can be re-created.

6.5.1 Standards

6.5.1.01 The accuracy of sample target analytes quantitation is directly related to the accuracy of the standards used for instrument calibration. To ensure the highest quality standard, primary reference standards used by STL are obtained from the NIST or reliable commercial sources. When standards are received at the laboratory, the date received, supplier, lot number, purity and concentration, and expiration date are recorded in a standard logbook. Vendor certifications sent with the standards are also filed.

6.5.1.02 Standards purchased by STL may be in a pure form or in a stock or working standard solution. Often dilutions are made from vendor standards. All standards made are given a standard identification number and have the following information recorded in a standard logbook:

- Source of standard used to prepare dilution
- Preparer's initials
- Initial concentration
- Final concentration
- Solvent source and lot number of solvent
- Volume of final solution
- Volume of standard diluted

6.5.1.03 After preparation and before routine use, standards are validated. Validation procedures range from a check for chromatographic purity to verification of the concentration of the standard using a standard prepared at a different time or obtained from a different source. Reagents are also examined for purity by subjecting an aliquot or sub-sample to the analytical method in which it will be used. For example, every lot of dichloromethane (for organic extractable) is analyzed for undesirable contaminants prior to use in the laboratory. Standards are routinely checked for signs of deterioration (e.g., discoloration, formation of precipitates, and changes in concentration), and they are discarded if deterioration is suspected or their expiration date has passed. Expiration dates may be taken from vendor recommendations, analytical methods, or internal research.

6.5.2 Explosives Method Calibration

6.5.2.01 The field of chromatography involves a variety of instrumentation and detection systems. While calibration requirements vary depending on the type of analytical system and methodology, the following principles of calibration generally apply.

- Calibration occurs before any sample quantitation.
- Initial five-point calibrations are performed periodically, which encompass the reporting limit.
- Daily standards (initial calibration verification [ICV] standards) are analyzed prior to sample analysis.
- Continuing calibration verification (CCV) standards are analyzed at a specific frequency throughout the sample analysis.

6.5.2.02 Sample quantitation is with an external calibration technique.

6.5.2.03 The laboratory will meet the requirements in Attachment H.

6.5.2.04 See Attachment F for STL Chicago’s explosive calibration and corrective actions.

6.5.3 Metals Method Calibration

Twenty-three metals listed in Subchapter 6.2.2 will be analyzed by ICAP, and mercury will be analyzed by CVAA. Both techniques are discussed below. The laboratory will follow the SOPs in Attachment F, and calibration and corrective actions are described there.

6.5.3.1 Inductively Coupled Argon Plasma

6.5.3.1.01 Prior to any sample analyses, the ICAP is calibrated daily using criteria prescribed in the analytical method. The calibration is then verified using a standard from an independent source ICV. The working range of the instrument is established each quarter-year with a linear range verification check standard. Sample quantitation may not be performed outside the linear range.

6.5.3.1.02 An initial instrument calibration is established daily by analyzing a minimum of two standards, one of which is a calibration blank (CB). The calibration is monitored throughout the day by analyzing a continuing calibration blank (CCB) and a CCV after every 10 samples. The CCV is a standard at the mid-range of the calibration. If the verification standard and blank do not meet established criteria, an SDR must be completed. The SDR procedures include examination of instrument performance and analysis information, consultation with the group leader, and a decision path to determine if re-calibration and re-analysis of samples back to the previously acceptable calibration check is warranted.

6.5.3.1.03 An inter-element check standard is analyzed at the beginning and end (or after 8 hours) of each analytical run on the ICAP to verify that inter-element and background correction factors have remained constant. Results outside of the established criteria require re-analysis of samples.

6.5.3.2 Mercury Cold-Vapor Atomic Absorption

Each AA unit is calibrated prior to any analyses being conducted. A calibration curve is prepared with a minimum of a CB and three standards, and it is then verified with a standard that has been prepared from an independent source. The calibration is then verified on an ongoing basis with a CCB and a CCV. If the ongoing calibration standard and blank do not meet established acceptance criteria, the SDR form must be completed describing what action should be taken.

6.6 Laboratory Quality Control Procedures

6.6.1 Analytical Sequence Quality Control

6.6.1.1 Metals by ICAP and Mercury

1. Initial calibration (daily)
2. ICV (after initial calibration)
3. Initial calibration blank (ICB) (after initial calibration)
4. Inter-element check (beginning of analytical sequence)
5. CCB (every 10 samples and end of analytical sequence)
6. CCV (every 10 samples and end of analytical sequence)
7. Method blank (MB) (1 per sample batch)
8. Laboratory control sample (LCS) (1 per sample batch)
9. Matrix spike (MS) (1 per sample batch)
10. Matrix duplicate (MD) (1 per sample batch)

11. Post digestion spike (as needed)
12. Serial dilution (as needed)
13. Method of Standard Additions (MSA) (as needed with samples with matrix effects)

6.6.1.2 Explosives by HPLC

1. Initial calibration (daily)
2. ICV (after initial calibration)
3. CCV (every 10 samples and end of analytical sequence)
4. MB (1 per sample batch)
5. LCS (1 per sample batch)
6. MS/matrix spike duplicate (MSD) (1 per sample batch)
7. Surrogates (on each sample, standard, blank, and QC sample)
8. Confirmation (on all positive results)

6.6.1.3 Perchlorate by Ion Chromatography (IC)

1. Initial calibration (daily)
2. ICV (after initial calibration)
3. CCV (every 10 samples and end of analytical sequence)
4. MB (1 per sample batch)
5. LCS (1 per sample batch)
6. MS/MSD (1 per sample batch)

6.6.2 Batch / Matrix-Specific / Performance-Based Quality Control

Laboratory performance QC is required to ensure that the laboratory systems (instrumentation, sample preparation, analysis, data reduction, etc.) are operating within acceptable QC guidelines during data generation. Laboratory QC samples consist of MBs, instrument blanks, and LCSs. In addition to laboratory performance QC, matrix-specific QC is utilized to determine the effect of the sample matrix on the data being generated. Typically, this includes the use of MSs, MSDs, sample duplicates, and surrogate compounds.

6.6.2.1 Quality Control Project Batch

6.6.2.1.01 The QC batch consists of a set of up to 20 field samples from this project with the same matrix (e.g., aqueous, solid, waste) that are processed using the same procedures, reagents, and standards within the same time period. The subcontractor laboratories for this project will utilize this definition of a QC batch.

6.6.2.1.02 In addition to the up to 20 non-QC samples, an analytical batch includes the following QC samples: MB, MS, MSD, and LCS.

6.6.2.2 Method Blanks

6.6.2.2.01 The MB is an Ottawa sand for solid samples and measures laboratory-introduced contamination for the batch. The MB is carried through every aspect of the procedure followed for samples, including preparation, cleanup, and analysis, and is analyzed with each QC batch processed.

6.6.2.2.02 The MB is used to identify any interferences or contamination of the analytical system that may lead to the reporting of elevated analyte concentrations or false positive data. Potential sources of contamination include solvent, reagents, glassware, other sample processing hardware, or the laboratory environment.

6.6.2.2.03 Typically, the requirements for MBs are that any analytes detected must be below half of the reporting limit. If there are any positive results for a MB (above or below the reporting limit), the data are evaluated to determine impacts and whether the associated sample results are adversely impacted.

6.6.2.2.04 It is a goal to have no detected target analytes in the MBs, but analytes may be periodically detected in blanks due to the nature of the analysis or the reporting limit of the analyte. For ICAP metals analyses, copper, zinc, and iron may sometimes be found in MBs. For these common laboratory contaminants, data may be reported with qualifiers if the concentration of the analyte is less than five times the MDL. Any laboratory contaminants found in the MB will be discussed in the report narrative.

6.6.2.2.05 Blank subtraction shall not be performed for this project.

6.6.2.3 Instrument Blank

6.6.2.3.01 The instrument blank is an unprocessed aliquot of reagent used to monitor the contamination of the analytical system at the instrument. Instrument blanks are typically analyzed on each day the instrument is used, and can be replaced by an MB.

6.6.2.3.02 System contamination may lead to the reporting of elevated analyte concentrations or false positive data. The instrument blank does not undergo the entire sample preparation process and generally consists of an aliquot of the same reagent(s) used for a sample dilution.

6.6.2.3.03 If an instrument blank shows any positive results, analysis is halted and corrective action implemented to remove the contamination. If the instrument blank was a part of an automatic run, the same criteria and evaluation process is used as for an MB.

6.6.2.4 Laboratory Control Samples

6.6.2.4.01 Ottawa sand fortified with known amounts of selected target analytes is used for the LCS for solid samples. The LCS is carried through every aspect of the procedure, including preparation, cleanup, and analysis of the samples. An LCS is prepared and analyzed with each QC project batch processed.

6.6.2.4.02 Review of the LCS recovery data is used to monitor the performance of the analytical methods. Day-to-day performance is characterized by evaluation of the accuracy of the results. Ongoing monitoring of the LCS results provides evidence that the laboratory is performing the method within both acceptable accuracy and precision guidelines.

6.6.2.4.03 The recoveries of spiked analytes, LCS, are compared to control limits generated from historical data. If any analyte is not within control limits, the data are evaluated to determine the severity of the impact on sample data quality. See Attachment H for the corrective action that will be taken when data exceed the control limits, and see Attachment F for the SDR form.

6.6.2.5 Matrix Spike

6.6.2.5.01 The MS is an environmental sample to which known concentrations of selected target analytes have been added. MSs are analyzed to evaluate the effect of the sample matrix on the analytical methodology. The MS undergoes the same extraction and analytical procedures as the unfortified client sample. An MS is prepared and analyzed for each 20 samples processed where appropriate.

6.6.2.5.02 Evaluation of MS recovery data is used to monitor the effects that the sample matrix may have had on the performance of the analytical method. Due to the potential variability of the matrix of each sample, these results may have immediate bearing only on the specific sample spiked and not on all samples in the QC batch.

6.6.2.6 Matrix Spike Duplicate

6.6.2.6.01 The MSD is a second aliquot of the same sample used for the MS that is spiked with known concentrations of selected target analytes. The MSD is analyzed with the associated sample and MS. The MSD undergoes the same extraction and analytical procedures as the unfortified client sample. An MSD is prepared and analyzed with each QC batch processed where appropriate.

6.6.2.6.02 The results of the MSD by itself are evaluated in the same manner as the MS. The results of the MS and MSD are compared to determine the effect of the matrix on the precision of the analytical process. Due to the potential variability of the matrix of each sample, the MS/MSD results may have immediate bearing only on the specific sample spiked and not on all samples in the QC batch.

6.6.2.6.03 The relative percent difference (RPD) between the duplicate MSs is compared to precision control limits. If any analyte is not within precision control limits, the failure is ascribed to matrix effects (usually sample non-homogeneity) and the data reported with narration.

6.6.2.7 Sample Duplicate

6.6.2.7.01 A sample duplicate is a second aliquot of an environmental sample taken from the same sample container. It is processed in the same manner and at the same time as the first aliquot of the sample. For most projects, a duplicate is prepared and analyzed only when MS/MSDs are not possible.

6.6.2.7.02 The results of the sample and its duplicate are compared to determine the effect of the matrix on the precision of the analytical process. Due to the potential variability of the matrix of each sample, the sample duplicate results may have immediate bearing only on the sample analyzed in duplicate.

6.6.2.7.03 The RPD between the duplicates is compared to in-house-generated precision control limits. If any analyte is not within precision control limits, the failure is ascribed to matrix effects (usually sample non-homogeneity) and the data reported with narration.

6.6.2.8 Surrogates

6.6.2.8.01 Surrogates will be used by STL Chicago for Method 8330 (explosives). Surrogates are organic compounds that are similar in chemical composition and behavior to the target analytes but are not normally found in environmental samples. Known amounts of the surrogates are added to samples and QC samples being tested for organic analytes.

6.6.2.8.02 Review of surrogate data is used to monitor the effect of the sample matrix and the accuracy of the analysis.

6.6.2.8.03 The recoveries of spiked surrogates are compared to control limits generated from historical data. If any analyte is not within control limits, the data are evaluated to determine the severity of the impact on sample data quality.

6.6.2.8.04 Surrogates are analyzed only with organic analyses such as the analysis of explosives.

6.6.2.9 Interference Check Sample

6.6.2.9.01 An interference check sample is a solution containing known concentrations of both interfering and analyte elements. Analysis of this sample will be used to verify background and inter-element correction factors (metals analyses only).

6.6.2.9.02 A minimum of one set of interference check sample solutions will be analyzed at the beginning of each ICAP sequence. See the ICAP SOP in Attachment F for the specific criteria for the interference check sample.

6.7 Performance and System Audits

6.7.01 Internal and external audits are conducted regularly at the laboratory to ensure that the guidance provided in this document and in project-specific documents is followed. Internal audits are performed by each laboratory's QA department, which is responsible for all QA/QC functions in that laboratory, and/or members of the professional laboratory staff who do not normally work in the section being audited.

6.7.02 To provide an independent and unbiased review of laboratory operation, the laboratory participates in external audits conducted by persons who are not direct employees of the laboratory. Two types of audits are performed in each laboratory. Performance audits require the analysis of blind samples or other samples whose values are not known to the analytical areas. These results are used to evaluate the accuracy of the laboratory analytical system. Systems audits involve an in-depth review and evaluation of some or all components of the analytical laboratory to determine the proper application of guidelines listed in this document and/or each laboratory's laboratory quality manual (LQM).

6.7.1 Internal Audits

6.7.1.01 The QA department at the laboratory conducts several audits (systems, data) during the course of each calendar year. During these audits, one or more components of the laboratory are reviewed to determine if that part is functioning in compliance with the requirements specified in the LQM, the approved SOP, and approved methodology. An audit report, listing deficiencies that must be addressed in order to correct or improve the laboratory operations, is prepared.

6.7.1.02 The laboratory performs an annual double blind performance evaluation study in which all systems to which a client is normally exposed are evaluated, including customer service and turnaround time. The analytical and subjective results of the study are distributed to the analytical department within the laboratory for corrective action when applicable.

6.7.2 External Audits

6.7.2.01 Each subcontractor laboratory undergoes systems audits as needed to satisfy certification or project requirements. These audits are conducted by the certifying agency or contractor with the full cooperation of the laboratory staff and management.

6.7.2.02 Each subcontractor laboratory also regularly participates in three semiannual performance testing studies: water supply, water pollution, and soil studies.

6.8 Non-Conformance and Corrective Actions

6.8.01 QC elements are used to monitor and assess the validity of sampling and analysis activities. Formal corrective actions (see Attachment F, SOP UQA-029) will be initiated in each subcontractor laboratory if (a) data are determined to be of questionable validity, or (b) if QC elements are not within required limits, or (c) if a performance trend develops. For routine problems, the analysts correct the problem and document such activity in the analytical run log or worksheet, and a formal corrective action report is not required.

6.8.02 Within each subcontractor laboratory, any employee aware of a problem related to one or more samples is responsible for initiating an SDR (Attachment F).

6.8.1 Internal Corrective Actions

Examples of QC elements generally monitored by each subcontractor laboratory are listed in Subchapter 6.5 and Subchapter 6.6. Other method-specific QC elements are also monitored during routine operations. See Attachment F for the corrective actions for each method.

6.8.2 External Corrective Actions

Any actions deemed necessary by EEG, USACE, or any other external regulatory or certifying agencies will be taken by the affected subcontractor laboratory as necessary. These actions are most likely to arise from a systems or performance audit, or from data review conducted by the agency.

6.8.3 Documentation

6.8.3.01 SDRs will be used by the subcontractor laboratories to document deficiencies and exceptions that may impact data quality, production, efficiency, or relations with STL Chicago or USACE. To the extent possible, the laboratories will resolve all situations that require corrective action before data quality is compromised. These non-conformance actions do not require documentation in a formal SDR.

6.8.3.02 The following standards apply to corrective actions:

- The Job Sample Receipt Checklist Report (Attachment E) is a form of corrective action report. It documents problems encountered during sample receipt.
- If there is a critical problem that requires immediate action (e.g., samples received after holding time expired, holding time missed during the analytical process, insufficient sample volume), the laboratory will notify EEG's laboratory coordinator immediately and the corrective action designed in consultation with USACE.
- If the laboratory reports data whose QC elements are not within criteria, the exceptions are noted in the case narrative.
- If the laboratory discovers any problems after the report has been sent to the client (e.g., after system or data audit, client inquiries, external review), a formal SDR will be initiated.

6.8.4 Sample Discrepancy Report Responsibility

6.8.4.01 SDRs are the responsibility of the laboratory staff. Any laboratory employee who becomes aware of a problem with any aspect related to reported data is responsible for initiating an SDR. In most cases, this will be primarily the analysts' responsibility, but any reviewer or person in contact with the client that becomes aware of a problem must initiate a formal corrective action report.

6.8.4.02 The laboratory's project manager or point of contact as shown in Chapter 2 is responsible for reporting to the laboratory project manager and to EEG's project chemist all corrective actions taken by the laboratory for this project. The laboratory project manager is responsible for ensuring that the action is implemented and documented in the case narrative. EEG's project chemist is responsible for reporting the action to EEG's project manager and to the USACE project chemist.

6.8.5 Sample Discrepancy Report Approval

SDRs (see Attachment F) are approved by the originating laboratory's project manager and QA manager, and completed SDRs are filed in the affected project file(s).

7.0 Data Reduction / Calculation of Data Quality Indicators

Project quality indicator, precision, and accuracy measurements employed by the subcontracted laboratories to support this project are summarized in Attachment H.

7.1 Precision

7.1.01 Precision is an estimate of variability, i.e., it is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. The precision of a measurement system is generally affected by random errors (e.g., sample non-homogeneity). For this project, precision will be expressed as RPD between duplicate measurements.

7.1.02 Calculation of RPD between duplicates:

$$RPD = \frac{\left|Value\ 1 - Value\ 2\right|}{Value\ 1 + Value\ 2} x100$$

7.2 Accuracy (Bias)

7.2.01 Accuracy is a measure of the agreement of an analysis result and a true or expected value, or between the average of a number of measurements and the true or expected value. Systematic errors affect accuracy. For chemical properties, accuracy is expressed as a percent recovery (%R) or as percent bias (100 – %R).

7.2.02 For this project, accuracy will be measured by analyzing spiked samples (e.g., MS or LCS), or by adding surrogate compounds for organic tests. Percent recovery is calculated using the following equations. When measured using an MS, accuracy measurements are specific to the sample used and may not reflect on the accuracy of associated samples.

7.2.03 Calculation of %R for MSs:

$$\%\,\mathrm{R} = \frac{Amount\ found\ in\ spiked\ sample - Amount\ found\ in\ unspiked\ (native)\ sample}{Amount\ spiked}\ x\ 100$$

7.2.04 Calculation of %R for LCSs and surrogates:

$$\%R = \frac{Amount \quad found}{Amount \quad spiked} \; x \; 100$$

7.3 Sample Quantitation / Reporting Limits (Limit of Detection)

7.3.1 Calculation of Control Limits

RPDs are statistical control limits based on laboratory historical data and derived on an annual basis. For accuracy, the QC analytes in a given matrix are tabulated over time and a mean recovery is established, as is the standard deviation(s) of those recoveries.

7.3.2 Method Detection Limit

7.3.2.01 The subcontractor laboratories use MDLs that are verified annually (or more frequently) as described below. The MDL is three to five times lower than the reporting limit, which is included in most calibration curves and verified daily. The MDL therefore represents a value that can be reliably detected and distinguished from noise levels.

7.3.2.02 Annual verification of the MDLs is performed according to procedures described in 40 CFR Part 136, Appendix B.

- MDLs are calculated for each analyte (provided it can be spiked) and matrix type (aqueous, solid).
- An MDL study is performed whenever a new instrument is placed on line, if the configuration of any one instrument is changed, or if the sample preparation method or technique is changed.
- The mean of the seven measured concentrations of the MDL spikes, divided by the empirically determined MDL, should be between 1 and 5 for reagent water matrix, and between 1 and 10 for other matrices. Otherwise, the spike concentrations should be adjusted and the MDL studies repeated.
- If multiple instruments with identical configurations are used, the MDL study is performed using one of the instruments. An MDL verification check sample (see below) is analyzed on the other instruments to verify sensitivity.
- If a method is performed using multiple instruments with similar configurations, the MDL study will be performed on the least sensitive instrument; however, the MDL verification check sample will be analyzed on all instruments.

- MDL samples are prepared using all preparation and cleanup techniques routinely used on samples.
- The static MDL is verified if it is equal to or higher than the measured MDL.
- If the static MDL is not verified by the measured MDL, the MDL can be verified by an MDL check sample that meets criteria.
- Each MDL study is followed by an MDL verification check sample (see below).

7.3.2.03 If the annual MDL study is delayed, the previous or theoretical MDL is verified on a quarterly basis until the MDL study can be completed. The MDL verification check sample:

- Consists of a blank (deionized water, Ottawa sand) spiked with the target analytes at a concentration up to two times the static MDL
- Is prepared using all preparation and cleanup techniques routinely used on samples
- Is analyzed on all instruments routinely used for that method/technique
- Must have a response that is readily distinct from the instrument's noise level (signal-to-noise ratio is equal to or greater than 3) or the analyte can be readily identified and quantified (i.e., detected)

7.3.2.04 The primary evaluation feature of MDL study results is the spike-to-MDL ratio. The ideal ratio between the spike level and the MDL value is 5, for at this spike level the random effects of analytical variability (i.e., noise) are not overshadowed by the analyte signal. MDLs are always adjusted to reflect dilutions and, in the case of solid samples, moisture content. Dilutions required to analyze samples within instrument or calibration constraints and the presence of moisture in soil samples always results in increased reporting limits.

7.4 Data Completeness

7.4.01 Data completeness for acceptable data will be calculated as a percentage of acceptable data out of the total amount of data generated. For this project, acceptable data includes both data that passed all QC criteria and data that may not have passed all criteria but that had appropriate corrective action taken.

7.4.02 The formula for calculation of data completeness for acceptable data is:

$$\textit{\%Data completeness for acceptable data} = \frac{\textit{number of acceptable data}}{\textit{number of possible results}}$$

7.4.03 Data completeness for acceptable data is calculated and reported for each method, matrix, and analyte combination. For completeness requirements, acceptable data are all results not qualified with an R flag. The requirement for data completeness for acceptable data for this project is 90 percent for each individual analytical method.

7.4.04 Data completeness for quality data will be calculated as a percentage of quality data out of the total amount of data generated. For this project, quality data is only that data that has passed all QC criteria described in this QAPP.

7.4.05 The formula for calculation of data completeness for quality data is:

$$\textit{\%Data completeness for quality data} = \frac{\textit{number of acceptable data}}{\textit{number of possible results}}$$

7.4.06 The requirement for data completeness for quality data is 80 percent for each individual analytical method.

8.0 Laboratory Operations Documentation

8.0.01 The goal of the laboratory is to provide complete, accurate, and verifiable data. To meet this goal, procedures for ensuring the correctness of the data must be followed. Subchapter 6.5 discusses the key elements of the calibration procedures followed by the laboratory to ensure traceability of the results.

8.0.02 Documentation of data reduction requirements ensures that all calculations were performed according to method requirements, and that minimum guidelines are followed in generating the final sample results.

8.0.03 The objective of data verification is to provide results of a verifiable and acceptable quality whose validity is not jeopardized. The data verification process ensures that:

- The correct samples are reported
- No systematic errors were made in calculating the final results
- Samples were analyzed within calibration criteria
- Samples were analyzed within holding times
- QC elements monitored were within known acceptable limits

8.0.04 The purpose of data reporting is to pass on the analytical information to the user. The information must be complete according to the user's needs and in a format that meets the user's requirements.

8.1 Sample Management Records

8.1.01 Data reduction is the first step to sample management records and refers to all activities that convert analytical values into final sample concentrations of the target analytes. These activities may involve analyte ID, mathematical calculations, and summary statistics. The laboratory will calculate results as described in the SOPs (Attachment F).

8.1.02 Initial data reduction is the responsibility of the analyst who performs the analysis. The analyst is responsible for:

- Ensuring that samples are analyzed only when the instrument is calibrated according to the method
- Ensuring that QC results (spike recoveries, precision for duplicates) are calculated correctly and within criteria, and, if not, initiating corrective actions
- Identifying QC results for review by the responsible person(s)

- Documenting sample preparation and analysis, and the conditions under which they were performed, in a bound laboratory notebook
- Ensuring that the laboratory sample ID is correctly transcribed into all analytical records
- Correctly entering all of the parameters needed for final result calculation, if the data reduction will be performed using computer-controlled data acquisition and data reduction
- Performing the calculations according to the method requirements, if data reduction will be performed using a pocket calculator
- Ensuring that the entry is made correctly, if the result is transcribed
- Performing data review on their own or on peer data
- Alerting a supervisor about any problems that the analyst believes may affect the quality of the data

8.1.1 Manual Data Reduction

8.1.1.01 Manual data reduction refers to those activities in which analytical output is converted to analyte concentration in samples by calculations performed manually. The analyst:

- Ensures that all data are correctly transcribed into worksheets, forms, or computer applications
- Keeps raw data as a part of the analysis records, if the analytical instrument used generates hardcopy reports (strip charts, tabular reports, etc.)
- Selects the appropriate, method-specified formulae for calculating results (the formulae used are written in the SOPs)
- Proofreads computer-generated reports to ensure that the raw data manually entered into the computer application is correct

8.1.1.02 Raw data hardcopy reports are identified with date of analysis, laboratory sample ID, analyst, and referenced method or SOP.

8.1.2 Computer Data Reduction

8.1.2.01 Computer data reduction refers to those activities in which analytical acquisition and initial calculations are performed automatically by validated computer applications. Appropriate to the method used, the analyst will:

- Ensure that all variables required for final calculations (sample amount, dilution factor, extract volume, percent solids, surrogate amount, etc.) are entered correctly

- Verify that computer IDs are correctly made
- Calculate surrogate recoveries and verify that internal standard responses are acceptable
- Verify that target compounds analyzed by chromatographic methods are within the appropriate retention time or relative retention time windows

8.1.2.02 Raw data files are assigned a unique filename by the analyst performing the analyses. In some instances, the computer performs the filename assignment using rules that ensure that filenames will not be repeated. Files containing sample-specific information (laboratory sample ID, sample amount, dilution factor, etc.) are cross-referenced to each raw data file using application functionality. The sample analysis logbooks can be used as an alternative cross-reference between the laboratory sample ID and the raw data file name.

8.1.3 Significant Figures

8.1.3.01 All organic results are rounded to two significant digits. Inorganic and geotechnical results are reported to two significant figures if the value is less than 10, and to three significant figures if greater than or equal to 10.

8.1.3.02 Whenever data is reduced using computer applications, the rounding rules used are those provided with the operating software. During manual calculations, the following rounding rules are followed.

- If the digit to be dropped is less than 5, do not change the last digit to be retained (e.g., 2.23 rounds off to 2.2).
- If the digit to be dropped is greater than 5, increase the last digit to be retained by one (e.g., 2.26 rounds to 2.3).
- If the digit to be dropped is equal to 5, increase the last digit to be retained by one if it is odd (e.g., 2.35 rounds to 2.4) or do not change the last digit to be retained if it is even (e.g., 2.45 rounds to 2.4).

8.1.4 Data Review

8.1.4.01 All analytical data generated at each laboratory are extensively checked for accuracy and completeness. The laboratory is responsible for ensuring that valid data includes several levels of review. Each level demands specific action to prevent unqualified release of erroneous data and to correct problems discovered during the review process. Each subcontractor laboratory data validation process will include data generation, reduction, and three levels of review.

8.1.4.02 The Level 1 review is performed by the analyst who generates the analytical data. The analyst reviews the data package to ensure that:

- Sample preparation information is correct and complete
- Analysis information is correct and complete
- The appropriate SOPs have been followed
- Analytical results are correct and complete
- QC samples are within established control limits (blanks are acceptable)
- Special sample preparation and analytical requirements have been met
- Documentation is complete (e.g., all anomalies in the preparation and analysis have been documented; out-of-control forms, if required, are complete; holding times are documented, etc.)

8.1.4.03 Level 2 review is performed by the laboratory QA officer, whose function is to provide an independent review of the data package. This review is structured to ensure that:

- Calibration data are scientifically sound, appropriate to the method, and completely documented
- QC samples are within established guidelines
- Qualitative ID of sample components is correct
- Quantitative results are correct
- Documentation is complete and correct (e.g., anomalies in the preparation and analysis have been documented; out-of-control forms, if required, are complete; holding times are documented, etc.)
- The data are ready for incorporation into the final report
- The data package is complete and ready for data archive

8.1.4.04 Level 2 review is structured so that all calibration data and QC sample results are reviewed, and all of the analytical results from 10 percent of the samples are checked back to the bench sheet. If no problems are found with the data package, the review is considered complete. If any problems are found with the data package, an additional 10 percent of the samples are checked to the bench sheet. The process continues until no errors are found, or until the data package has been reviewed in its entirety. Level 2 data review is documented, and the signature of the reviewer and the date of review recorded. The reviewed data are then approved for release and a final report is prepared.

8.1.4.05 Before the report is released to EEG, the laboratory project manager reviews the report to verify the accuracy and completeness of the Level 2 review and ensure that the data meets the overall objectives of the project. This review is the Level 3 review.

8.1.4.06 Each step of this review process involves evaluation of data quality based on both the results of the QC data and the professional judgment of those conducting the review. This application of technical knowledge and experience to the evaluation of the data is essential in ensuring that data are of consistently of high quality.

8.1.5 Other Review

The data derived from this project must be evaluated and approved by a Puerto Rico licensed chemist in accordance with Puerto Rico Department of Environmental Quality guidelines.

8.1.6 Procedures for Handling Unacceptable Data

All QC information will be recorded in the notebooks and printouts. It is the analyst's responsibility to check the QC information against limits for the analysis. When analysis of a QC sample (blank, spike, check standard, replicate, or similar sample) shows that the analysis of that batch of samples is not in control, the analyst will perform corrective action or bring the matter to the attention of the group leader. The group leader will, if necessary, consult with the laboratory QA officer or the laboratory project manager to determine whether the analysis can proceed, whether selected samples should be rerun, or whether specific corrective action needs to be taken before analyzing additional samples. Out-of-control analyses must be documented. The analyst or group leader will file an SDR with the laboratory QA officer for laboratory analysis out-of-control events that require documentation.

8.2 Data Reporting Procedures

8.2.1 Data Package Format and Contents

The laboratory will supply a definitive data package. The definitive data package format allows for the review of the data by an independent organization but the data package does not allow for complete independent reconstruction of the analytical data. Definitive data are produced using rigorous analytical methods, such as USEPA standard reference methods (e.g., SW-846, Contract Laboratory Program). Analyte presence and quantitation are confirmed through extensive QC procedures at the laboratory, which may be on site or off site. As discussed in more detail in the following chapters, the definitive data package will include a cover sheet, table of contents, case narrative, the analytical results, laboratory reporting limits, sample management records, and internal laboratory QA/QC information. The laboratory data package will be organized such that the analytical results are reported on a per-batch basis unless otherwise specified.

8.2.1.1 Cover Sheet

8.2.1.1.01 The cover sheet will specify the following information:

- Title of report (i.e., Test Report, Test Certificate)
- Name and location of laboratory (to include a point of contact, with telephone and fax numbers)
- Name and location of subcontractor laboratories, and appropriate test method performed
- Contract number
- Client name and address
- Project name and site location
- Statement of data authenticity and official signature and title of person authorizing report release

8.2.1.1.02 Amendments to previously released reports shall clearly identify the serial number for the previous report and state the reason(s) for reissuance of the report.

8.2.1.2 Table of Contents

Laboratory data packages will be organized in a format that allows for easy identification and retrieval of information. An index or table of contents will be included for this purpose.

8.2.1.3 Case Narrative

A case narrative will be included in each report. The case narrative will contain a table or tables summarizing samples received, providing a correlation between field sample numbers and laboratory sample numbers, and identifying which analytical test methods were performed and by which laboratories. Samples that were received but not analyzed will also be identified. Extractions or analyses that are performed out of holding times will be appropriately noted. The case narrative will define all data qualifiers or flags used. Deviations of any calibration standards or QC sample results from appropriate acceptance limits will be noted, and associated corrective actions taken by the laboratory will be discussed. Any other factors that could affect the sample results (e.g., air bubbles in volatile organic compound [VOC] sample vials, excess headspace in soil VOC containers, the presence of multiple phases, sample temperature and sample potential of hydrogen (pH) excursions, container type or volume, etc.) will be noted.

8.2.1.4 Analytical Results

The results for each sample will contain the following information, at minimum (information need not be repeated if noted elsewhere in the data package):

- Laboratory name and location (city and state)
- Project name and unique ID number
- Field sample ID number as written on custody form
- Laboratory sample ID number
- Matrix (soil, water, oil, etc.)
- Sample description
- Sample preservation or condition at receipt
- Date sample collected
- Date sample received
- Date sample extracted or prepared
- Date sample analyzed
- Analysis time when holding time limit is less than 48 hours
- Method (and SOP) numbers for all preparation, cleanup, and analysis procedures used
- Preparation, analysis, and other batch numbers
- Analyte or parameter
- Method reporting limits adjusted for sample-specific factors (e.g., aliquot size, dilution/concentration factors, moisture content)
- Method quantitation limits (low-level standard concentration)
- MDLs
- Analytical results with correct number of significant figures
- All confirmation data
- Any data qualifiers assigned
- Concentration units
- Dilution factors (All reported data shall reflect any dilutions or concentrations. The dilution factor, if applicable, will be noted on the analytical report. If neat and/or diluted results are available, data from all runs will be recorded and reported.)

- Percent moisture or percent solids (all soils, sediments, sludges, etc., are to be reported on a dry weight basis)
- Chromatograms, as needed
- Sample aliquot analyzed
- Final extract volume

8.2.1.5 Laboratory Reporting Limits

The laboratory may use a reporting limit expressed in terms of detection limit, quantitation limit, regulatory action level, or project-specific threshold limits; however, the laboratory's use of these terms must be well-defined. In addition, the "<" (less than) reporting convention must be used in accordance with the requirements established in Subchapter 7.3.

8.2.1.6 Sample Management Records

These types of records include the documentation accompanying the samples (i.e., original chain-of-custody record, shipping documents, laboratory notification sheets), records generated by the laboratory that detail the condition of the samples upon receipt at the laboratory (i.e., sample cooler receipt forms, any telephone conversation records, etc.), and any records generated to document sample custody, transfer, analysis, and disposal.

8.2.1.7 Quality Assurance / Quality Control Information

The minimum data package must include the calibration, calibration verification, and internal laboratory QA/QC data with their respective acceptance criteria. The data package will also include the laboratory's method quantitation and reporting limits for project-specific parameters. The calibration data shall include a summary of the ICV, all calibration verification standards, and any performance standards analyzed in conjunction with the test method. All calibration deviations shall be discussed within the case narrative. The data package will correlate the method QC data with the corresponding environmental samples on a per-preparation batch basis with batch numbers clearly shown. Method QC data must include all spike target concentration levels, the measured spike concentration and calculated recoveries, all measures of precision, including RPD, and all control limits for bias and precision. This would include laboratory performance information such as results for MB, recoveries for LCSs, and recoveries for QC sample surrogates; and matrix-specific information such as MD RPDs, MS and MSD recoveries, MS/MSD RPDs, field sample surrogate recoveries, serial dilutions, and post digestion spike, etc. At minimum, internal QC samples will be analyzed and reported at rates specified in the specific methods, within USACE guidance, or as specified in the contract, whichever is greater. Any deviations from the measurement quality objectives will be noted. The data package will also include any data review, non-conformance, or corrective action forms.

8.2.2 Electronic Deliverables

8.2.2.01 Electronic chemical data will be provided to CEHNC in the Analytical Data Review (ADR) format. STL will develop a comprehensive library file for all of the methods to be analyzed under this Scope of Work. The library file will accurately reflect all of the analytical quality requirements as documented in the final Sampling and Analysis Plan for this project and will be provided to CEHNC for use in screening electronic data deliverable (EDD) submittals.

8.2.2.02 All electronic data submitted by STL will be error-free and in complete agreement with the hardcopy data. Data files are to be delivered both by e-mail and on high-density compact disk accompanying the hardcopy data reports. The disk must be submitted with a transmittal letter from the laboratory that certifies that the file is in agreement with hardcopy data reports and has been found to be free of errors using the latest version of the ADR evaluation software provided to the laboratory. STL will archive the electronic raw data and sufficient associated hardcopy data (e.g., sample log-in sheets and sample preparation log sheets) to completely reconstruct the analyses that were performed for a period of 10 years after completion of this contract.

8.3 Data Management Procedures

8.3.1 Laboratory Turnaround Time

The laboratory turnaround time will be 28 days for the complete data package. Copies of the results only can be received after 14 days

8.3.2 Data Archive / Retention Requirements

The laboratory will retain all records that pertain to this project for a minimum of five years from the date the records are formally archived. Archived record indexes are maintained in a database, which allows rapid retrieval of the archives. Archives are stored on site and are protected against fire, theft, loss, deterioration and vermin. Electronic records are protected from deterioration caused by magnetic fields and/or electronic deterioration.

9.0 Data Assessment Procedures

9.1 Data Quality Control Review

Data QC review is discussed in Subchapter 8.2.

9.2 Data Verification / Validation

9.2.01 EEG's project chemist will conduct an independent data validation prior to data acceptance. All samples for all methods and analytes in this project will be validated. This data validation shall include all data documentation from raw data to the reported results in accordance with the requirements specified in the following documents:

- Project FSP
- Project QAPP
- Subcontractor laboratories' SOPs and LQMs
- USEPA SW-846 Update IIIA, 1999
- DQOs in Attachment H

9.2.02 A thorough review of all data documentation from the raw data to the reported results will be performed. For each method, the following types of data will be reviewed to verify that they are complete and support the reported values.

9.2.1 Method 6010B – Metals

- Case narrative
- Sample IDs
- Chain of custody
- Holding time
- Initial calibration
- Instrument precision
- ICV
- ICB
- Inter-element check standards
- CCB
- CCV
- MB
- LCS

- MS
- MSD
- Post digestion spike
- Serial dilution
- MSA

9.2.2 Method 7471A – Mercury

- Case narrative
- Sample IDs
- Chain of custody
- Holding time
- Initial calibration
- Instrument precision
- ICV
- ICB
- CCB
- CCV
- MB
- LCS
- MS
- MSD
- Post digestion spike
- Serial dilution
- MSA

9.2.3 Method 8330 – Explosives

- Case narrative
- Sample IDs
- Chain of custody
- Holding time
- Initial calibration
- ICV
- CCV

- MB
- LCS
- MS
- MSD
- Surrogates
- Target analyte confirmation

9.2.4 Method 314 – Perchlorate

- Case narrative
- Sample IDs
- Chain of custody
- Holding time
- Initial calibration
- Second source verification
- Instrument performance check
- ICV
- CCV
- MB
- Pretreated laboratory blank
- LCS
- MS
- MSD

9.2.4.01 Following completion of this review, the project chemist will prepare a narrative report describing the data validation process and its results. Data qualifiers will be added to the analytical results report following USACE guidelines if the subcontractor laboratory did not already flag them. If data reported by the subcontractor laboratory are rejected, EEG will consult with the contracting officer regarding appropriate corrective actions.

9.3 Data Quality Objectives Reconciliation

The project chemist will determine if the DQOs summarized in the Sampling and Analysis Plan were attained. Contract compliance is assessed to ensure that stated requirements for daily QC have been met. The daily quality report, the contractor's data validation report, results from performance evaluation samples, field oversight findings, and/or project-specific laboratory audits will all be reviewed to assure that the DQOs have been met.

9.4 Project Completeness Assessment

9.4.01 Data completeness for acceptable data is calculated as a percentage of acceptable data out of the total amount of data generated. The formula is number of acceptable data divided by number of possible results. For this project, acceptable data includes both data that passed all QC criteria and data that may not have passed all criteria but had appropriate corrective action taken.

9.4.02 Data completeness for acceptable data is calculated and reported for each method, matrix, and analyte combination. For completeness requirements, acceptable data are all results not qualified with a rejected (R) flag. The requirement for data completeness for acceptable data for this project is 90 percent for each individual analytical method.

9.4.03 Data completeness for quality control data will be calculated as a percentage of quality data out of the total amount of data generated. For this project, quality data is only that data which has passed all QC criteria described in this QAPP.

9.4.04 The formula for percent completeness is:

$$\%complete = \frac{A - B}{A} \times 100$$

Where:

A = Total number of measurements

B = Total number of unacceptable measurements

ATTACHMENT A

USACE Chemical Data Quality Management Procedures and Notification

Chapter 1
U.S. ARMY CORPS OF ENGINEERS CHEMICAL DATA QUALITY MANAGEMENT PROCEDURES AND NOTIFICATIONS

1-1. Introduction. Execution of the USACE Chemical Data Quality Management (CDQM) program for HTRW contamination requires the interface and coordination of several Corps personnel. Procedures and responsibilities for USACE staff performing government CDQM activities are defined and detailed in this Chapter. The USACE project manager (PM) is responsible for initiating and coordinating the defined CDQM activities.

1-2. Goals of the CDQM Program. The goals of the USACE CDQM program are to: 1) generate data of acceptable quality for the intended use; 2) satisfy the needs of the customer and the regulators; 3) generate sufficient data of known quality on the first attempt; and 4) provide an historical record for potential future use. When CDQM is used properly, the PM can readily measure the success of the team in meeting the project-specific DQOs. The USACE CDQM program consists of activities presented in ER 1110-1-263, CDQM for Hazardous Toxic and Radioactive Waste Remedial Activities, Engineer Manual (EM) 200-1-1, Validation of Analytical Chemistry Laboratories, EM 200-1-2, Technical Project Planning Guidance for HTRW Data Quality Design, and EM 200-1-3, Requirements for the Preparation of Sampling and Analysis Plans (SAPs).

1-3. Technical Project Planning. Each district is responsible for assessment of chemical data quality, including determination of data useability and DQO attainment. The district project chemist is a critical team member for this effort, and must be involved in preparation and review of project documents including scopes of work, SAPs, contract specifications, and final chemical data reports. The district project chemist must be involved at each step of an HTRW project, so that adequate data quality is maintained. The TPP process for design of DQOs is described in EM 200-1-2.

1-4. CDQM Activities. All HTRW projects require a comprehensive and multifaceted approach to QC and QA in order to achieve and document attainment of appropriate quality for the intended data usage. The district project chemist is the focal point to ensure that chemical data meet DQOs for each HTRW project. The district project chemist has several techniques to monitor and ensure the quality of chemical data. The district project chemist in conjunction with other members of the TPP team determine the appropriate level of compliance monitoring as discussed in ER 1110-1-263, Appendix A. This determination should be based upon the intended use of the data and the degree of confidence needed in the quality of the data. Compliance monitoring may consist of a combination of activities. Described below are twelve (12) activities that may be applied on a project-specific basis to assist in generating data of known quality. The twelve CDQM activities, their relative cost, and typical use are summarized in Table 1-1.

a. Validation of Primary and QA Laboratories. In general, commercial and government laboratories that support the USACE HTRW program should obtain a USACE laboratory validation prior to field studies or sample analysis. The QA laboratory is defined as the Chemistry and Materials Quality Assurance Laboratory (CMQAL), located in Omaha, Nebraska or a subcontracted agent that is responsible for analysis of the project QA samples. For some data uses, other programs (*i.e.*, State Fuel Storage Tank Program, A2LA, Navy and Air Force Installation Restoration Program (IRP) Audits) can be utilized. Projects should not be implemented without utilization of information from some accreditation authority. Validation should be maintained throughout the duration of the project. The USACE laboratory validation program is project specific. The validation is a parameter, method, and matrix-specific approval. For each new contract or delivery order awarded during the validation period, a project-specific request for validation should be sent to CENWO-HX-C (Corps of Engineers, Northwestern Division, Missouri River Region, HTRW-Center of Expertise, Chemical Data Quality Management Branch) for verification of laboratory status regardless of their expiration date on the list of validated laboratories. The primary objectives of the USACE laboratory validation program are to communicate to analytical service providers the USACE QC/QA requirements, verify the laboratories are performing specified analytical methods, and to ensure these laboratories meet the USACE requirements prior to sample analysis. Laboratory validations are performed under the administration of the HTRW-CX applying guidance outlined in EM 200-1-1. The USACE validation program is primarily based on SW-846 methods. The first step of the validation program is a paper review of the laboratory's capabilities to ensure that the proposed laboratory has the facility, equipment and personnel to meet the project required analyses. The laboratory must demonstrate capabilities by providing acceptable standard operating procedures (SOP) and successfully analyzing project required performance evaluation (PE) samples. The final step of the validation program is an on-site inspection of the laboratory's facility. Validation can be terminated at any step of the process due to inadequate laboratory documentation performance and/or execution. No notice or short notice on-site audits of facilities listed as USACE validated are available, but require the participation of at least one member of the project planning team.

b. Technical Document Review. The roles and responsibilities for document review are defined in the Environmental Cleanup and Protection Management Plan for Military Programs, 17 January 1996 and Corps of Engineers, Military Programs Directorate, Environmental Division, Policy and Technology Branch (CEMP-RT) Memoranda: 1) Environmental Cleanup and Protection Management Plan for Military programs, 17 January 1996; and 2) Technical Roles and Responsibilities for the USACE HTRW Program, 23 September 1997 (herein referred to as the HTRW Management Plan).

(1) HTRW Project Technical Verification Process. It is the responsibility of the contractor and the district to produce a quality product. Rather than employing multiple levels of detailed document review to ensure quality, the technical verification process transfers project

responsibility to the district and its contractors. In general, the HTRW design district is responsible for a QC review of the prime contractor's QC Plan and all project-specific deliverables. QC Plans, scopes of work, and other project documents completed in-house should be reviewed by an independent technical review function established by the design district. The Major Subordinate Command (MSC) will provide oversight of the district's QC process. Only inventory project reports for the FUDS program require approval at the division level. Districts may request HTRW-CX participation in a design district's independent technical review process. The MSCs may request HTRW-CX support in performing QA oversight and audits of HTRW design districts QC processes. HTRW-CX review is required on Category B projects (see below).

(2) HTRW Project Technical Categories. The HTRW design district screens each HTRW project against the decision tree criteria provided in Attachments 1 and 2 of the Management Plan to determine the appropriate review process. Category A includes all routine HTRW (as defined in the Management Plan), and all projects in the Preliminary Assessment(PA) phase and those beyond the Site Inspection (SI) or Resource Conservation Recovery Act (RCRA) Facility Assessment (RFA) phase. Category A excludes, however, National Priorities List (NPL) sites, Base Realignment and Closure (BRAC) sites, sites where innovative technologies are used, and sites with construction estimates greater than $5 million. Category B includes all projects not in Category A, and any projects of special district, MSC, or HQ concern.

(3) Roles and Responsibilities for Review of Specific HTRW Products. Review responsibilities will vary depending on the category (Category A or Category B) of projects. The HTRW design district is responsible for all reviews of projects in Category A (Attachments 1, 2, and 3 of the Management Plan). Key documents for projects in Category B will be reviewed and approved by the HTRW design district and reviewed by the HTRW-CX. The PM provides appropriate technical documents to the HTRW-CX and QA laboratory for their information or review. Technical chemistry review by the HTRW-CX will be completed within two weeks for a Scope of Work and within three weeks for all other documents from time of receipt. If shorter review times are required, the PM coordinates with the Technical Liaison Manager (TLM) at the HTRW-CX. Comments from the HTRW-CX will be provided to the PM for all projects reviewed. A copy of all review comments and responses is placed in the permanent project file. Districts/centers with insufficient staff chemist resources to provide in-house review should rely upon the military design district, CMQAL or the HTRW-CX for document review. Note only certain key documents have been identified for HTRW-CX review as Category B projects; these are identified in Table 2 of the Management Plan. In addition, Chemical Quality Assurance Reports (CQARs)(Chapter 4) and Chemical Data Quality Assessment Reports (CDQARs) (Chapter 5) from all projects will be sent to the HTRW-CX. The HTRW-CX is responsible for 10% review of both CQARs and CDQARs. A summary of the reviews will be sent quarterly to CEMP-RT by the HTRW-CX.

c. Sample Handling Quality Assurance. The QA laboratory provides quick feedback regarding problems with sample shipments. The QA laboratory is responsible for checking the sample shipment for temperature, proper preservatives, correct containers *etc.* The Technical Manager (TM) or district project chemist is then notified within 24 hours regarding the status of the sample shipment via facsimile, electronic mail or telephone call. For most projects, this is beneficial because problems are detected and resolved while the sampling team is still in the field. This approach reduces the re-mobilizations to the field. The CMQAL or contract QA laboratory, and the primary laboratory complete and report a "Cooler Receipt Checklist" for all shipments sent to the laboratory. An example cooler receipt checklist is found in EM 200-1-1. A chain-of-custody (CoC) record must be initiated at the sampling stage and maintained throughout the analysis and reporting stages of the process. Sample reports must be easily traceable to CoC records. All documentation pertaining to sample receipt or analysis should be included in the laboratory's data report. If this function is performed without analysis of QA samples, samples must either be shipped back to the project site or additional funds provided to properly dispose of samples.

d. QA Sample Collection and Analysis. QA sample collection and analysis is the main tool to determine that the data generated by primary laboratories is technically valid and of adequate quality for the intended data usage. Based on the needs of the project, a percentage of samples are homogenized (except samples for volatiles testing, which are co-located), split, given a unique sample identification (ID) and sent to a primary contract laboratory and to a QA laboratory for analysis. QA sample collection does not have to be performed at the same frequency or rate for all test parameters, on all matrices, during all project phases, nor for any one type of project. General considerations should include: 1) the data use and users as defined by the project-specific DQOs; 2) the total number of samples being generated (*e.g.*, a larger number of total samples collected may lower the percentage of QA samples needed); and 3) the need for statistically significant information from QA sample data. Ideally, the USACE QA sample collection and analysis program is an interactive process whereby the QA laboratory in conjunction with the TM or district project chemist detects and solves problems as sampling and analysis occurs to ensure that the data generated for the project meets the project DQOs. The "value added" by this program can be divided into two areas.

(1) Detecting Analytical Problems. A primary function of the QA laboratory is to analyze samples as prescribed by the project and produce a data package that is reviewed real-time (at the bench during the time of analysis) for later comparison to the primary laboratory's data. Analysis and comparison of the QA sample data to the primary sample data can reveal problems with primary laboratory data even when all other data quality measurements are in control. A common problem is over-dilution of semi-volatile organic analytes by the contract laboratories. Analysis by the QA laboratory can help in deciding whether this was due to actual matrix effect or due to inadequate sample cleanup by the primary laboratory.

(2) Salvaging Data Useability. When the data comparison shows good correlation between the QA laboratory and primary laboratory data, this may bolster the credibility and useability of the data generated by the primary laboratory. This is especially true in cases where primary laboratory data comes under close scrutiny and fails some data quality criteria. Good correlation also reflects consistency in the sampling process, the lack of which is a major source of error or variation. The criteria that establish acceptable correlation between project, QC and QA sample results are described in Chapter 4.

e. Chemical Quality Assurance Reports (CQARs). CQARs are usually prepared by the CMQAL. The CQAR documents review of the QA laboratory data and the corresponding primary laboratory data. Data for project samples, QC samples and QA samples are compared, and the impact on the primary laboratory's data is documented. CQAR format is discussed in Chapter 4.

f. Chemical Data Quality Assessment Reports (CDQARs). CDQARs are prepared by the district project chemist. The CDQAR documents data useability, DQO attainment, and contract compliance. CDQAR format is discussed in Chapter 5.

g. Single or Double Blind PE Sample Analysis. Another means of testing the analyst's proficiency in identifying and quantifying analytes of interest is the use of single or double blind PE samples. The composition of PE samples is known to the originator, but not the analyst. In a single blind PE sample, both the originator and the analyst know that the sample is a PE sample. The USACE uses single blind PE samples as part of the process to validate laboratories. In a double blind PE, the sample is containerized, labeled, and submitted as an environmental sample. The analyst does not know that the sample is a PE sample; ideally, the PE sample will be indistinguishable from the other project samples. The use of double blind PE samples is considered a more effective way of detecting problems, since the laboratory would not be aware that it was being evaluated. However, it may be difficult to disguise a standard reference sample as a project sample. PE sample data are evaluated for compound ID, quantitation, and sample contamination. PE samples are recommended for sites that have the potential for a majority of non-detects, or for sites where the contaminants of concern have already been identified. Currently, the complete range of organic and inorganic PE samples are available for water only. Selected organic and inorganic PE samples are available for soil.

h. Review of Primary Laboratory Data. An independent data review of the entire primary data set should be performed by the prime contractor for contracted projects. In addition, the district project chemist or QA laboratory should review a portion of the primary laboratory data. The percentage of primary laboratory data reviewed by the government depends upon the project-specific DQOs. The district project chemist or CMQAL should review all the primary laboratory data for in-house projects. Data review is conducted to ensure that: 1) QC data provided in the laboratory deliverables are scientifically sound, appropriate to the method, and completely documented; 2) QC samples are within established guidelines; 3) data were appropriately flagged by the laboratory; 4) documentation of all anomalies in sample preparation and analysis is complete and correct; 5) corrective action forms, if required, are complete; 6) holding times and preservation are documented; 7) data are ready for incorporation into the final report; and 8) data package is complete and ready for data archive. Details of the data review process are described in Chapter 3.

i. Validation of Data. Data validation is the process of data assessment in accordance with EPA regional or national functional guidelines or project-specific guidelines. Data validation includes assessment of the whole raw data package from the laboratory.

j. Field Audits. Sample collection field oversight is discussed in detail in Chapter 6. Audits should be performed on both an announced and unannounced basis, and should be coordinated with government geotechnical personnel, as appropriate. Audits may be performed during any stage of the project.

(1) Procedures. The auditor is responsible for checking that samples are collected and handled in accordance with the approved project plans and for confirming that documentation of work is adequate and complete. Specifically, the auditor should ensure that performance of field activities satisfies the project DQOs. Original records generated for all audits are retained within permanent project files. Records may include audit reports, written responses, record of the completed corrective actions, and documents associated with the conduct of audits that support audit findings and corrective actions. Checklists included in Chapter 6 can be used to guide performance of a field audit. For construction activities, the audit should assess the prime contractor's implementation of the three-phase chemical data control process. Details on contractor QC of field activities are found in EM 200-1-3.

(2) Personnel. Trained and experienced personnel should perform the field audits. These personnel should be knowledgeable in the subjects necessary for assessing the quality of the work being observed, including thorough knowledge of the contractual requirements. Preferably, field audits should be carried out by government personnel. The field audits may be performed by contract personnel with some objective relationship to the work being conducted in the field (*e.g.*, a prime contractor auditing its subcontractors).

(3) Desk Audit of Field Activities. Another mechanism for auditing field activities as they occur is to include government technical review of Daily QC Reports and field logs while the contractor is in the field. Desk audits of field activities require that these reports be supplied on a periodic basis (*e.g.*, daily or weekly) to the USACE technical staff. The requirement for periodic reporting must be included in the contract specifications or project delivery order, as well as in the project work plans. Since the contractor knows of this reporting requirement, it is not possible to perform an unannounced desk audit of field work.

k. Laboratory Audits. The primary and QA laboratories are responsible for maintaining detailed procedures to support the validity of all analytical work. Laboratory audits may consist of on-site inspections and/or analysis of PE samples. The audit verifies the laboratory's continuing ability to produce acceptable analytical data. If a performance problem is identified for sample analysis or data reporting, the HTRW-CX reserves the right to audit the laboratory anytime during the eighteen month period of validation. Laboratory audits may be carried out on either an announced or unannounced basis. More detail on this type of audit is found in EM 200-1-1.

l. Tape Audits. The purpose of a raw data review (tape audit) is to assess the quality of the data and to evaluate the overall laboratory performance. This information is then used by the data user to evaluate data quality and make a determination on the acceptability and the useability of the data. The tape audit is designed to independently verify the data reduction practices of an individual laboratory. All of the raw data from a given batch is recalculated by the evaluator and is compared to the results reported by the laboratory. The data quality is measured by laboratory compliance with the required methods and acceptable laboratory practices for analysis and for data reduction. Tape audits can only be performed when a specific analytical instrumental raw data output has been stored electronically. To implement this type of audit the contract must require the laboratory to provide electronic data (*i.e.,* magnetic tapes) needed to perform the audit. In addition, a means to read the data must be made available.

1-5. Primary CDQM Activities. While all twelve of the CDQM activities discussed in the previous section may be used on a project, six of the twelve should be used on most projects. The six primary CDQM activities for USACE HTRW projects are 1) validation of primary and QA laboratories, 2) technical document review, 3) sample handling QA, 4) QA sample collection and analysis, 5) preparation of CQARs by a qualified entity, and 6) preparation of CDQARs by the district project chemist. These elements should routinely be considered as candidates for inclusion in each project's set of CDQM activities.

a. Documentation of Selected CDQM Activities. The CDQM activities selected for each project shall be documented in the project-specific DQOs. A recommended procedure for documentation of the CDQM process is presented in American National Standard, Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC E-4-1994).

b. Waiver of CDQM Activities. ER 1110-1-263 allows for any aspect of the program to be waived except for the DQO element specified in ER 1110-1-263 Section 7.b. ER 1110-1-263 states that all other CDQM elements may be waived for a specific project by the district PM with concurrence from the technical project team as defined in EM 200-1-2. The intent of ER 1110-1-263 is to provide a flexible CDQM program that produces data of known quality to satisfy the project-specific DQOs.

c. Documentation of Waiver. If the district project chemist in conjunction with the PM and technical project team decides not to use all of the six primary CDQM elements discussed above, a memorandum for record (MFR) is required. The district PM must document in the MFR what procedures will replace the waived compliance monitoring activity and demonstrate the concurrence of the technical project team including the district project chemist. The district project chemist will typically be tasked by the PM to prepare this documentation. The MFR should include the PM's signature and the project team's concurrence along with the following elements: 1) brief description of the project; 2) summary of the project objective; 3) description of the waived CDQM activities; and 4) description of alternate procedures to ensure data quality. Districts with insufficient staff chemist resources to provide technical team support should rely upon other HTRW design districts, the CMQAL, or the HTRW-CX for chemistry support.

1-6. Use of QA Samples by Project Phase. The use of QC and QA samples is a particularly powerful tool for maintenance of data quality. With primary, QC and QA data for a single sampling point one may perform both inter-laboratory and intra-laboratory data comparisons. In addition, QA samples may provide unique indications about the quality of the primary laboratory's data. The following sections describe the use of QA samples in various project phases.

a. Investigative Phase. The use of QA samples during the investigative phase adds value by verifying the analytes of concern and quantifying the levels of contamination. In general, QA samples are targeted in locations of known or expected contamination. If the primary and QA laboratory data are comparable, then this provides an additional level of confidence that the correct action was taken. If the primary laboratory data does not compare with the associated QA laboratory data, then this assures that the data from the site will be completely evaluated prior to a decision. In addition, the QA laboratory data yields information regarding the spatial heterogeneity of the soil contamination.

b. Pre-Design Phase. The pre-design phase of the HTRW program consists of bench and pilot scale studies. If data generated from these activities are used to size the system, accuracy of results is critical. Any false positive or false negative from the bench or pilot study could result in costly changes following construction of the completed system. QA sample collection provides a verification of the prime contractor's results for use in their design.

c. Remedial Action Phase. The remedial action phase of the HTRW program consists of treatment system analytical support. Verification of results from the actual treatment operations is a critical check for long-term operation of the system. QA samples would be useful during the early stages of the project when the system is optimized or at stages of major equipment changes. Many treatment systems focus on discharge quality, and verification of the results aids in the acceptability by the regulators.

d. Post-Remedial Action Monitoring. The post-remedial action phase of the HTRW program typically includes post-excavation confirmation sampling and/or treatment system analytical support. QA sample checks on post-excavation samples can bolster regulator's confidence in the effectiveness of remediation. Analytical support during the operation and maintenance (O&M) phase can last up to thirty years in the case of long-term monitoring. In all likelihood, the primary laboratory would change several times during the course of a long-term monitoring project. Use of the same QA laboratory would be instrumental in providing continuity from one laboratory's results to another and for resolving problems that inevitably arise when a large volume of data is collected over a long period of time.

1-7. Omission of QA Samples. For certain projects, QA samples may not be the best method of ensuring attainment of DQOs. The decision to omit QA samples for a given project must be made by the district project chemist in conjunction with the PM and technical project team. Omission of QA samples should be based on meeting project objectives and goals, rather than simply to reduce cost. The district chemist must balance the need to maintain quality with the need to perform work for a reasonable cost. The project categories that may not be good candidates for QA sample collection are described below.

a. Underground Storage Tank (UST) Removals. Samples collected to meet state or federal requirements pertaining to UST removals may omit QA samples if regulatory deadlines preclude the QA process.

b. Lead Paint Testing. Construction building material and debris sampling to test for leaded paint is not generally considered to be HTRW work. Samples of building materials or debris collected solely to test for the presence of leaded paint will not typically benefit from use of QA samples.

c. Asbestos Testing. Construction building material and debris sampling to test for asbestos is not generally considered to be HTRW work. Samples of building materials or debris collected solely to test for the presence of asbestos will not typically benefit from use of QA samples.

d. Process Monitoring. Samples collected to demonstrate the day-to-day efficacy of intermediate steps during a treatment process will not typically employ QA samples. However, collection of QA samples from the treatment system influent and discharge locations is recommended on an occasional basis.

e. Waste Characterization. Samples collected of drummed materials, tank contents, barrels, and similar materials for hazardous waste profiling do not usually employ QA samples.

f. Treatability Studies. Samples collected as part of a treatability study to demonstrate the efficacy of a remedial process do not usually employ QA samples. QA samples are recommended for optimization studies.

g. Air Samples. Samples collected as part of an ambient air monitoring program usually do not employ QA sample collection. Specifically, this would apply to co-located air samples for both gas phase and particulate related components since co-located samples are not homogeneous. Gas phase samples collected with a split sampling device are likely to be homogeneous, and QA samples may provide added value.

h. Wipe Samples. Wipe samples (*i.e.*, for polychlorinated biphenyls (PCB) analysis) will not usually benefit from QA sample collection since co-located wipe samples are not identical.

i. Non-routine Methods. Certain methods are experimental, or laboratory-specific, and it is not possible to replicate them in a QA laboratory. If duplication of the method is difficult, QA samples are not usually employed.

j. Screening Data. Samples collected as part of a screening program usually do not employ QA sample collection. This would include screening data generated from immunoassay test kits, x-ray fluorescence, colormetric, or field gas chromatography analyses.

1-8. Fraud Deterrence. Although not specifically designed to detect fraud, the USACE QC/QA program of laboratory validation, auditing (laboratory and field), sample receipt inspections, and review, verification, and/or validation of project, QC and QA data serves as a creditable deterrent to fraud.

1-9. Training. A number of training sessions are available (both internal and external to USACE) to provide the needed understanding of the principles and proper execution of the USACE CDQM program. USACE staff are encouraged to avail themselves of this training as appropriate.

1-10. Procedures for CDQM by Project Phase. The following outlines the procedures for CDQM for the investigative, pre-design and design, and remedial or removal action phases of the USACE HTRW program. The outlined activities demonstrate use of the six primary CDQM activities described in Section 1-5 and the technical document review process for Category A projects described in Section 1-4.b.

a. Investigative Phase. The investigative phase of the HTRW program consists of site characterization, engineering analysis, risk assessment, potentially responsible party (PRP) data gathering, and regulatory analysis. The investigative phases from the CERCLA process are the PA/SI and the Remedial Investigation/Feasibility Study (RI/FS). The investigative phase from the RCRA process are the RCRA Facility Assessment (RFA), RCRA Facility Investigation (RFI) and the Corrective Measures Study (CMS). The investigative phase of the FUDS program is executed consistent with, but not identical to, the CERCLA process. For non-time critical removal actions, a PA/SI is performed initially and is followed by an Engineering Evaluation/Cost Analysis (EE/CA). The EE/CA takes the place of the RI/FS.

(1) HTRW design district writes Scope of Services. For Category B projects (see paragraph 1-4.b.(2)), the HTRW design district submits Scope of Services to HTRW-CX for review.

(2) HTRW design district solicits prime contractor services.

(3) HTRW design district negotiates and awards contract or delivery order.

(4) Prime contractor identifies primary laboratory to the district.

(5) The PM, TM or district project chemist requests validation of the primary laboratory by the HTRW-CX via electronic mail or facsimile.

(6) The HTRW-CX follows the process described in EM 200-1-1 to validate the laboratory. If the laboratory has not previously been validated by the HTRW-CX, the district project chemist should screen the laboratory to determine if its technical capabilities merit validation. Depending on the laboratory's validation status, some or all of the following procedures may be omitted. If requested by the HTRW-CX, the primary laboratory submits its Laboratory Quality Management Manual (LQMM) or Quality Assurance Plan (QAP), a representative SOP; to demonstrate the laboratory has the capability to run the required methods, and petroleum hydrocarbon SOPs (if necessary) to the HTRW-CX. Based on satisfactory review of the QAP and SOPs, PE samples are sent if available. The laboratory is then inspected by HTRW-CX. Personnel from the HTRW design district and CMQAL will be notified of a scheduled inspection and may assist with this process. If the laboratory fails to become validated, another laboratory should be selected.

(7) The prime contractor submits the SAP, consisting of a Quality Assurance Project Plan (QAPP) and a Field Sampling Plan (FSP), for HTRW design district's approval. Other environmental regulatory programs may require different documentation than a SAP. For Category B projects (see paragraph 1-4.b.(2)), the HTRW design district sends SAP to HTRW-CX and HTRW-CX reviews the SAP and makes recommendations to HTRW design district.

(8) From the SAP, the HTRW design district or the CMQAL makes an estimate of the cost of QA sample analysis. The budgeted amount must be funded by the HTRW design district to the CMQAL prior to sending samples for QA analysis. The QA laboratory must also be notified that QA samples will be sent. The HTRW design district must provide the QA laboratory with the following information: 1) project name; 2) approximate sampling dates; 3) number of samples; 4) matrix (matrices); 5) analyses; 6) DQOs; and 7) turnaround time. An example checklist to

submit this information is included as Figure 1-1.

(9) Field work begins after SAP is approved by the HTRW design district.

(10) The TM or district project chemist coordinates with the prime contractor for field and laboratory activities. Samples are collected in the field with project and QC samples sent to the primary laboratory and QA samples sent to the QA laboratory. QA samples are sent to the QA laboratory throughout the duration of the sampling effort or as defined by the project objectives.

(11) The primary and QA Labs should be notified upon final shipment of project samples.

(12) Prime contractor's analytical results are submitted to the HTRW design district within the time frame identified in the contract. The analytical results that correlate with the QA samples are sent to the CMQAL at the same time.

(13) The QA laboratory or another qualified entity prepares the CQAR and submits it to the HTRW design district and the HTRW-CX. The HTRW design district provides the CQAR to the prime contractor for inclusion in the project report.

(14) Prime contractor prepares the draft project report and submits it to the HTRW design district. The project report should include the CQAR, as well as the contractor's assessment of the primary laboratory data. The report is reviewed by the same office(s) that reviewed the SAP.

(15) District project chemist writes the CDQAR addressing data useability and DQO attainment from information received from the prime contractor and the CQAR. CDQARs must be prepared for all in-house and contractor executed projects. CDQARs will be sent by the HTRW design district to the HTRW-CX for all projects.

b. Pre-Design and Design Phase. The pre-design and design phase of the HTRW program consists of remedial action selection and design. The CERCLA design phase is remedial design (RD). The corresponding RCRA phase is called the Corrective Measures Design (CMD). The following outline applies when the design is prepared by a contractor. Modifications will be required if the design is performed in-house.

(1) Design district writes Scope of Services. For Category B projects (see paragraph 1-4.b.(2)), the HTRW design district submits Scope of Services to HTRW-CX for review.

(2) Design district solicits prime contractor services.

(3) Design district negotiates and awards prime contractor design contract or delivery order.

(4) If investigative activities are included in the design contract, steps 4-15 of paragraph 1-10.a. should be followed.

(5) Prime contractor submits Design Analysis Reports that contains a section that specifically addresses chemical quality management concerns. The prime contractor also submits plans and specifications which include chemical quality management at the preliminary, intermediate, and final phases. For the Total Environmental Restoration Contract (TERC), the prime contractor submits a Work Plan for each delivery order. All these documents are submitted by the prime contractor for HTRW design district's approval. The chemical section of the plans and specifications or work plan should give the construction contractor instructions for writing the SAP in addition to including all necessary site-specific chemical detail. For Category B projects (see paragraph 1-4.b.(2)), the HTRW design district submits these documents (to include the design analysis, plans and specifications, and the work plan) to the HTRW-CX for technical review, and comments are sent back to the design district.

(6) Design district assures that appropriate comments are addressed and incorporated into the documents. Revised documents and annotated comments are sent to the offices generating comments at the next submittal stage.

(7) Final (100%) plans and specifications are approved by the design district. From the contract specifications, a preliminary estimate is made of the funding required to support specified QA activities. The district advertises and awards the construction contract. For a Request for Proposal (RFP), the district solicits proposals from construction contractors. The district technical team evaluates the proposals and selects a contractor. Several other contracting mechanisms (*i.e.*, Invitation for Bid (IFB), cost-plus, *etc.*) exist that could be used instead of the RFP.

c. Remedial or Removal Action Phase. Many construction offices do not have sufficient chemistry training to make the decisions necessary to support the HTRW program. These construction offices should rely on basic chemistry support from resources at their HTRW design district, CMQAL or the HTRW-CX. Several guidance documents integrate chemical data QA for remedial actions into existing QA procedures for construction:

ER 415-1-10 Contractor Submittal Procedures

ER 1180-1-6 Quality Management

EP 715-1-2 A Guide to Effective Contractor Quality Control

CEGS 01451 Contractor Quality Control

CEGS 01450 Chemical Data Quality Control

(1) District representative requests validation of the primary laboratory by the HTRW-CX via electronic mail or facsimile.

(2) See paragraph 1-10.a(6) for the process and procedures for laboratory validation.

(3) The designated HTRW design district, CMQAL or HTRW-CX (depending upon which organization is providing the basic chemistry support for the project) assists the Construction District in reviewing the SAP and makes recommendations to the construction district. Construction district approves or disapproves the prime contractor's SAP.

(4) See paragraph 1-10.a.(8) for estimating and funding QA analysis.

(5) Construction begins after SAP and prime contractor's laboratory are approved.

(6) The construction representative coordinates with the prime contractor for field and laboratory activities. See paragraph 1-10.a.(10) for laboratory coordination and shipment. QA samples are sent to the QA laboratory throughout the duration of the sampling effort or as defined by the contract specifications.

(7) Prime contractor notifies the primary laboratory and the CMQAL when the final project samples have been sent.

(8) Prime contractor's analytical results are submitted to the construction office for transmittal to the CMQAL within the time frame identified in the contract.

(9) The QA laboratory or another qualified entity prepares the CQAR and submits it to the construction district, associated HTRW design district and the HTRW-CX. The construction district provides the CQAR to the prime contractor for inclusion in the project report.

(10) The prime contractor submits the project report to the construction district. The project report includes the CQAR, as well as the contractor's evaluation of the primary laboratory data. The report is reviewed by the construction representative with assistance from HTRW design district, CMQAL, or HTRW-CX staff, if requested.

(11) Construction district writes the CDQAR addressing contract compliance, data useability and DQO attainment from information provided by the construction contractor and the CQAR. CDQARs will be sent by the construction district to the associated HTRW design district, and HTRW-CX for all projects.

1-11. Data Management and Archive Process. The prime contractor and laboratories are responsible for generating, controlling and archiving laboratory and field records for all projects. This information should be maintained with a system that is effective for retrieval of any documentation that affects the reported results. The TM determines whether supporting data should be transferred from the prime contractor to the USACE upon contract completion or remain the prime contractor's responsibility for archiving the data. This includes record generation and control, security, and maintenance of all project related documents. The duration of laboratory data and field record retention should be specified as part of the project DQOs.

a. Laboratory. The laboratory prepares and retains full analytical and QC documentation that can be tracked from initiation to disposal for each sample. The following minimum records should be stored for each project: 1) original work order, CoC, and other pertinent documents received with the samples, 2) communications between the laboratory, field, and the customer, 3)any associated corrective actions, 4) laboratory data packages, 5) finalized data report, 6) laboratory log books, and 7) electronic data. The laboratory should also maintain its QAP and relevant SOPs for the methods performed.

b. Field. Project-specific records that relate to field work performed should also be retained. These records may include correspondence, CoC records, field notes, and reports issued as a result of the work. In addition, records that document all field operations should be retained. This may include equipment performance records, maintenance logs, personnel files, general field procedures, and corrective action reports. For field operations hard copy records are acceptable.

Laboratory Notification Information Checklist

__ project name
__ project location
__ general project objectives
__ intended use(s) of data
__ name and address of sampler's firm
__ approximate sampling dates
__ approximate number of samples, by matrix
__ required data package turnaround time
__ funding source (contract number and/or MIPR number)
__ name, phone and facsimile numbers for person to be contacted by the laboratory if there are problems with the sample shipment
__ name and address of primary (contractor's) laboratory (to be included in notification to CMQAL)
__ project specific requirements

- analysis method(s)
- matrices
- extraction method(s)
- required sensitivity (reporting limits)
- required precision
- required accuracy
- required comparability

__ sample retention after analysis is complete
__ disposition of samples after required retention time
__ special data reporting requirements
__ any special needs or comments (*i.e.*, unusual target analytes)
__ revision number of notification

Figure 1-1

Table 1-1 CDQM Activities

QA Activity	Characteristics	Cost	Project Phase(s) In Which Commonly Used					
			PA	SI or RFA	RI/FS or RFI/ CMS	RD or CMD	RA or CMI	O&M
Lab Validation	Provides assurance that lab has necessary personnel & equipment to produce data of known and adequate quality	*	X	X	X	X	X	X
Document Review	Checks technical adequacy of project documents and monitors program compliance	$ to $$	X	X	X	X	X	X
Sample Handling QA	Quick feedback regarding problems with sample shipments	$	X	X	X		X	X
QA Sample Collection & Analysis	Detects analytical problems and may salvage data usability	$$ to $$$$$	X	X	X		X	X
CQAR Preparation	Monitors intra- and inter-laboratory data comparability	$ to $$$$	X	X	X		X	X
CDQAR Preparation	Checks contract compliance, data usability, and DQO attainment	$ to $$	X	X	X		X	X
Performance Evaluation Samples	Provides assurance that lab correctly identifies and quantitates analytes of interest	$ to $$$$$	X		X			
Primary Lab Data Review	Monitors precision, accuracy, completeness, reproducibility, and sensitivity of primary data	$ to $$$	X	X	X		X	
Data Validation	Rigorous evaluation of data according to explicit EPA or other agency guidelines	$$ to $$$$	X		X			
Field Audits	Real-time oversight of accuracy & adequacy of field activities	$ to $$	X		X		X	
Laboratory Audits	Unannounced audits verify lab's ability to produce acceptable data	$ to $$			X			X
Tape Audits	Raw data review verifies data reduction procedures of lab	$$$$ to $$$$$			X			

Cost ratings range from $ to $$$$$. $ corresponds to <$1000, while $$$$$ corresponds to >$10,000.
* For most programs, the cost of laboratory validation is funded by the HTRW-CX, not by the district or division. If laboratory validation is requested for a project that is outside those programs for which there is validation funding by the HTRW-CX, validation costs would typically be in the range $$ to $$$.

ATTACHMENT B

Personnel Qualifications

Mark Bagel, PG

Experience

Mr. Bagel has 26 years of professional experience in environmental and engineering-related investigations in the following areas: contamination assessments of petroleum-contaminated, Superfund, and Resource Conservation and Recovery Act (RCRA) sites; solid waste and industrial waste landfill permitting and contamination assessments; stabilization study of organic sludges; oversight and evaluation of landfill liner and cover constructions; management and QC coordinator of ordnance-contaminated sites; supervision of geotechnical soils and materials testing laboratory; soil sampling and laboratory analysis for geotechnical soils investigations; preparation of Comprehensive Quality Assurance Plan and other QC and safety programs and plans, construction materials testing and analysis, and construction/demolition site QC manager.

Education

BA, Geology, State University of New York, 1978

- Geologic Studies, University of Houston, 1984
- Engineering Studies, University of Houston, 1986
- Engineering Studies, University of Florida, 1990 to 1994

Karen Hatfield, MS

Areas of Specialization

- Environmental Chemistry
- Project Management
- Data Validation
- Quality Control / Quality Assurance

Experience

Ms. Hatfield has 32 years of environmental and chemistry consulting experience in project management, environment chemistry, and environmental quality control. Her experience includes data validation, completion of Laboratory Quality Assurance Plans, data validation, and preparation of Quality Control Summary Reports. Her experience and insight has provided excellent and timely reports and plans to clients, meeting the client requirements within budget and on schedule.

Education

MS, Environmental Engineering Sciences, University of Florida
BS, Chemistry, University of Florida, 1971

Gary H. Tourtellotte, MS

Areas of Specialization

- NEPA Documentation
- Natural Resources Evaluations and Management
- Ecology of Marine and Freshwater Aquatic Communities
- Water Quality
- Design of Sampling Programs
- Data Analysis / Statistics

Experience

Mr. Tourtellotte has 25 years of experience in environmental consulting. His experience includes coastal resource evaluations and management, ecology of marine and freshwater aquatic communities, water quality, design of sampling programs, data analysis / statistics, NEPA documentation, power plant siting and impact analysis, phosphate mine impact analysis, and dredge and fill permitting. He has performed numerous studies of estuarine/marine and freshwater systems along the East Coast of the U.S. and the Gulf of Mexico. These studies have been in support of NPDES permitting, dredge and fill projects, siting of industrial facilities, environmental impact statements, environmental assessments, biological assessments, contamination and baseline surveys, and ecological risk assessment.

Education

MS, Oceanography, Old Dominion University, Norfolk, VA, 1979

BS, Biology, University of Miami, 1974

Environmental Toxicology and Risk Assessment Short Course, Duke University, School of the Environment, 1992

STL Personnel Profiles
Prepared for Ellis-Culebra Project

STL Chicago

Project Manager, Nancy S. McDonald

Ms. McDonald holds a B.A. in Biology from Augustana College. She has 16 years environmental laboratory experience. Her experience includes project management for industrial and municipal clients for wastewater discharge (NPDES), groundwater monitoring, soil and waste characterization. Ms. McDonald also provides support for engineering consultants contracted by the US Army Corps of Engineers (USACE) and US Navy. She has experience meeting the criteria in the USACE Louisville Chemistry Guidelines (LCG) and various state programs, including the Illinois EPA's Tiered Approach to Cleanup Objectives (TACO). Ms. McDonald previously served as the laboratory's proposal coordinator and initially worked in the field sampling department.

Quality Manager, Terese A. Preston

Ms. Preston has a B.A. degree in Biology from Jamestown College, Jamestown, ND. Ms. Preston is STL Chicago's Quality Manager. She has 21 years experience in the environmental laboratory industry and has been with the Chicago laboratory since 1984. She is experienced in environmental laboratory quality assurance practices, management, communications and analytical chemistry. Ms. Preston is responsible for the development and management of the laboratory's quality assurance program. She has considerable experience in preparing and implementing laboratory quality assurance and project specific plans, which include RI/FS and other projects for both the IEPA and U.S. EPA Region V contracts. She is an experienced laboratory data auditor, and performs contract and method compliance monitoring.

Customer Service Manager, Eric A. Lang

Mr. Lang has a M.B.A. with a concentration in Project Manage ment from Keller Graduate School of Management and a B.S. in Biology/Chemistry from Eastern Michigan University. He has 21 years experience in the environmental laboratory industry, with 13 years experience as a project manager. Mr. Lang serves as project manager for several large national industrial corporations and engineering clients, including work performed under U.S. Navy and U.S. Army Corps of Engineers contracts. He previously managed the laboratory's metals section where his responsibilities included implementation of quality control procedures, data package review, training of analysts in instrument operation, supervision of metals personnel and method development for metals analyses. Mr. Lang initially served as a chemist, performing inorganic analyses on water and waste samples.

Chromatography Laboratory Section Manager, Patti Gibson

Ms. Gibson has a B.S. in Biology (1984) from Oakland City College. She has 16 years experience in the environmental laboratory industry and has been with the Chicago laboratory since 1989. Ms. Gibson has been Unit Leader for the Pesticide/PCB group for approximately three years, with six years experience in GC analysis of pesticides and PCBs and has recently been promoted to Section Manager of Chromatography. She has experience utilizing methods from SW846, 40CFR, CLP OLM03.2 and OLC02.1. Her responsibilities included sample analysis, supervision of day to day operations and data review. She served in the metals department for one year performing various duties, including metals analysis on a Flame AA, metals digestions and TCLP extractions. Her initial duties were in log-in, where she worked for one year receiving, tracking and storing samples, entering log-in data in the computer system and reviewing associated paperwork.

Metals Laboratory Section Manager, Jodi L. Gromala

Ms. Gromala has a B.S. degree in Biology from Bradley University. She has over 19 years of laboratory experience. Ms. Gromala has an extensive background in inorganic metals analyses using SW-846 Methods, U.S. EPA CLP ILM04.0, Standard Methods for the Examination of Waters, EPA 600 Series Methods and ASTM Methods of Analyses. Previously Ms. Gromala was Unit Leader for the Metals Department and her experience includes ICP, GFAA and Hg analysis and Sample Preparation. She has been with the Chicago laboratory since 1988.

Sample Receipt Manager, Jeffrey A. James

Mr. James holds a B.A. in Music Education from Eastern Illinois University. He has 16 years of environmental laboratory experience and has been with the Chicago laboratory since 1989. Mr. James previously served as a project manager for several large industrial programs, including NPDES, municipal and wastewater clients. He now manages the Sample Receipt Department. His expertise includes consultation on the most cost effective approaches for environmental sampling. His experience includes sampling of a variety of matrices, well development, combustible gas monitoring, and field data collection. He has extensive training in environmental health and safety procedures, and hazardous shipping. Mr. James previously served as Field Sampling Unit Leader, Bottle Project Unit Leader, Facility Manager, and Field Technician.

STL Sacramento

Quality Assurance Manager, Pam Schemmer

Ms. Schemmer has a BS degree in Chemistry from the University of Iowa. She brings more than 12 years of experience in the analytical industry to her current role as Quality Assurance Manager. She began her career as an analyst, and quickly advanced into increasingly responsible management positions. Her attention to detail and excellent communication skills, make Ms. Schemmer an excellent contributor to our STL team. As a senior member of management Ms. Schemmer directs and monitors quality assurance activities at the Sacramento facility. She is responsible for reports to management, client concerns, project plan review, lab performance review, and review of procedures that will ensure the production of data of a defined quality.

Manager of Project Management, Robert Hrabak

Mr. Hrabak has a BS in Biological Sciences from the University of California. Over the past 16 years Mr. Hrabak has specialized in the area of the Advanced Technology Group, focusing on low-resolution dioxins and specialty chemicals. His extensive technical knowledge in these areas and excellent organizational skills, make him the ideal choice to manage these projects in the laboratory. His leadership ability was recognized in 1991 when he was included in a team of employees evaluating the application of high performance work teams in our environmental laboratory. These same skills were utilized in 1999 when he was chosen to coordinate the implementation of a new LIMS at the laboratory facility. In 1994 his customer focus and service skills were recognized by awarding him with the Presidential Exceptional Achievement Award, which is presented annually to only one percent of the company's employees.

ATTACHMENT C

Laboratory Certifications

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
12565 WEST CENTER ROAD
OMAHA NE 68144-3869

REPLY TO
ATTENTION OF

December 1, 2003

Hazardous, Toxic and Radioactive Waste
Center of Expertise

RECEIVED
DEC - 9 2003
SEVERN TRENT LABORATORIES
CHICAGO

Ms. Donna J. McCarthy
STL Chicago
2417 Bond Street
University Park, IL 60466-3182

Dear Ms. McCarthy:

This correspondence addresses the recent evaluation of STL Chicago of University Park, IL by the U.S. Army Corps of Engineers (USACE) for chemical analysis in support of the USACE Hazardous, Toxic and Radioactive Waste Program.

Your laboratory is now validated for the parameters listed below:

METHOD(1)	PARAMETER	MATRIX(1)
300.0	Anions(6)	Water(3)
300.0	Anions(6)	Solids(4)
9010B/9014	Cyanide	Water(3)
9010B/9014	Cyanide	Solids(3)
8330	Explosives	Water(4)
8330	Explosives	Solids(3)
8151A	Herbicides	Water(3)
8151A	Herbicides	Solids(3)
7196A	Hexavalent Chromium	Water(3)
3060A/7196A	Hexavalent Chromium	Solids(3)
1664A	Oil & Grease	Water(3)
9071B	Oil & Grease	Solids(4)
3510C/3520C/8081A	Organochlorine Pesticides	Water(3)
3541/3550B/8081A	Organochlorine Pesticides	Solids(3)
9065/9066	Phenolics	Water(3)
9065/9066	Phenolics	Solids(4)

3510C/3520C/8082	Polychlorinated Biphenyls	Water(3)
3541/3550B/8082	Polychlorinated Biphenyls	Solids(3)
3510C/3520C/8310	Polynuclear Aromatic Hydrocarbons	Water(3)
3541/3550B/8310	Polynuclear Aromatic Hydrocarbons	Solids(3)
3510C/3520C/8270C	Semivolatile Organics	Water(3)
3541/3550B/8270C	Semivolatile Organics	Solids(3)
3510C/3520C/8270C SIM	Semivolatile Organics and Polychlorinated Naphthalenes	Water(7)
3541/3550B/8270C SIM	Semivolatile Organics and Polychlorinated Naphthalenes	Solids(7)
3005A/3010A/6010B/ 3020A/7000A Series	TAL Metals(5)	Water(3)
3050B/6010B/7000A Series	TAL Metals(5)	Solids(3)
9060	Total Organic Carbon	Water(3)
9060M	Total Organic Carbon	Solids(4)
3510C/3520C/Mod 8015B	TPH - DRO	Water(3)
3541/3550B/Mod 8015B	TPH - DRO	Solids(3)
5030B/5035/Mod 8015B	TPH - GRO	Water(3)
5035/Mod 8015B	TPH - GRO	Solids(3)
5030B/5035/8260B	Volatile Organics	Water(3)
5035/8260B	Volatile Organics	Solids(3)

Remarks:

1) Sample preparation methods have been added to reflect program policy change.

2) "Solids" includes soils, sediments, and solid waste.

3) The laboratory has successfully analyzed a Proficiency Testing (PT) sample for this method/matrix.

4) Approval is based on review of SOPs, performance data, and PT results of other matrices.

5) TAL Metals: Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

6) Anions: Chloride, fluoride, sulfate, nitrate, nitrite, and ortho-phosphate.

7) Approval for polychlorinated naphthalene is based on review of SOPs and performance data only.

Enclosed for your information is a copy of the Laboratory Inspection and Evaluation Report. Please see the enclosed Laboratory Inspection and Evaluation Report for unresolved action items.

Based on the successful analysis of the National Environmental Laboratory Accreditation Conference Proficiency Testing samples for the appropriate fields of testing, the results of the laboratory inspection, and your Corrective Action Report, your laboratory will be validated for sample analysis by the methods listed above. The evaluation, which was conducted for your facility, is based substantially on ISO Guide 25 (General Requirements for the Competence of Testing Laboratories) and USACE Engineering Manual (EM) 200-1-3, Appendix I (Shell for Analytical Chemistry Requirements). The period of validation is 24 months and expires on December 1, 2005.

The USACE reserves the right to conduct additional laboratory inspections or to suspend validation status for any or all of the listed parameters if deemed necessary. It should be noted that your laboratory may not subcontract USACE analytical work to any other laboratory location without the approval of this office. This laboratory validation does not guarantee the delivery of any analytical samples from a USACE Contracting Officer Representative.

Any questions or comments can be directed to Chung-Rei Mao at (402) 697-2570. General questions regarding laboratory validation may be directed to the Laboratory Validation Coordinator at (402) 697-2574.

Sincerely,

Marcia C. Davies

Marcia C. Davies, Ph.D.
Director, USACE Hazardous,
Toxic and Radioactive Waste
Center of Expertise

Enclosure

STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL LABORATORY ACCREDITATION

is hereby granted to

STL CHICAGO
2417 BOND STREET
UNIVERSITY PARK, IL 60466-3182

ACCREDITATION NUMBER #100201

ACCREDITED IN ACCORDANCE WITH nelac

According to the Illinois Administrative Code, Title 35, Subtitle A, Chapter II, Part 186, ACCREDITATION OF LABORATORIES FOR DRINKING WATER, WASTEWATER AND HAZARDOUS WASTES ANALYSIS, the State of Illinois formally recognizes that this laboratory is technically competent to perform the environmental analyses listed on the scope of accreditation detailed below.

The laboratory agrees to perform all analyses listed on this scope of accreditation according to the Part 186 requirements and acknowledges that continued accreditation is dependent on successful ongoing compliance with the applicable requirements of Part 186. Please contact the Illinois EPA Environmental Laboratory Accreditation Program (IL ELAP) to verify the laboratory's scope of accreditation and accreditation status. Accreditation by the State of Illinois is not an endorsement or a guarantee of validity of the data generated by the laboratory.

Scott D. Siders

Scott D. Siders
Accreditation Officer
Environmental Laboratory Accreditation Program

Certificate No.: 001027
Expiration Date: 04/30/2005
Issued On: 04/27/2004

State of Illinois
Environmental Protection Agency
Awards the Certificate of Approval

Certificate No.: 001027

STL Chicago
2417 Bond Street
University Park, IL 60466-3182

According to the Illinois Administrative Code, Title 35, Subtitle A, Chapter II, Part 186, ACCREDITATION OF LABORATORIES FOR DRINKING WATER, WASTEWATER AND HAZARDOUS WASTES ANALYSIS, the State of Illinois formally recognizes that this laboratory is technically competent to perform the environmental analyses listed on the scope of accreditation detailed below.

The laboratory agrees to perform all analyses listed on this scope of accreditation according to the Part 186 requirements and acknowledges that continued accreditation is dependent on successful ongoing compliance with the applicable requirements of Part 186. Please contact the Illinois EPA Environmental Laboratory Accreditation Program (IL ELAP) to verify the laboratory's scope of accreditation and accreditation status. Accreditation by the State of Illinois is not an endorsement or a guarantee of validity of the data generated by the laboratory.

Drinking Water, Inorganic

SM2120B,18Ed

Color

SM2130B,18Ed

Turbidity

SM2150B,18Ed

Odor

SM2320B,18Ed

Alkalinity

SM2330B,18Ed

Corrosivity (Langlier Index)

SM2340B, 18Ed

Hardness

SM2340C,18Ed

Hardness

SM2510B,18Ed

Conductivity

SM2540C,18Ed

Total Dissolved Solids

SM4500CI-F,18Ed

Chlorine

SM4500CN-CE18Ed

Cyanide

SM4500F-C,18Ed

Fluoride

SM4500H-B,18Ed

Hydrogen ion (pH)

SM4500NO2B,18Ed

Nitrite

SM4500NO3F,18Ed

Nitrate

SM4500P-E,18Ed

Orthophosphate

SM5310C, 19Ed

Dissolved Organic Carbon   Total Organic Carbon (TOC)

Drinking Water, Inorganic

USEPA150.1

Hydrogen ion (pH)

USEPA180.1

Turbidity

USEPA200.7R4.4

Aluminum	Arsenic	Barium
Beryllium	Cadmium	Calcium
Chromium	Copper	Hardness (calc.)
Iron	Magnesium	Manganese
Nickel	Silica	Silver
Sodium	Zinc	

USEPA200.9R2.2

Antimony	Arsenic	Cadmium
Chromium	Lead	Selenium
Silver	Thallium	

USEPA245.1R3.0

Mercury

USEPA300.0R2.1

Chloride	Fluoride	Nitrate
Nitrite	Orthophosphate	Sulfate

USEPA353.2R2.0

Nitrate

Hazardous and Solid Waste, Inorganic

1010

Ignitability

1311

TCLP (Organic and Inorganic)

1312

Synthetic Precipitation Leaching Procedure

5050

Bomb Preparation

6010B

Aluminum	Antimony	Arsenic
Barium	Beryllium	Boron
Cadmium	Calcium	Chromium
Cobalt	Copper	Iron
Lead	Magnesium	Manganese
Molybdenum	Nickel	Potassium
Selenium	Silica	Silver
Sodium	Strontium	Thallium
Tin	Titanium	Vanadium
Zinc		

7041

Antimony

State of Illinois
Environmental Protection Agency
Awards the Certificate of Approval

Certificate No.: 001027

STL Chicago
2417 Bond Street
University Park, IL 60466-3182

Hazardous and Solid Waste, Inorganic

7060A
Arsenic

7131A
Cadmium

7191
Chromium

7196A
Chromium VI

7421
Lead

7470A
Mercury

7471A
Mercury

7740
Selenium

7761
Silver

7841
Thallium

9010B
Cyanide

9014
Cyanide

9020B
TOX - Total Organic Halides

9030B
Sulfides

9034
Sulfides

9038
Sulfate

9040B
Hydrogen Ion (pH)

9041A
Hydrogen Ion (pH)

9045C
Hydrogen Ion (pH)

9050A
Specific Conductance

9056
Bromide　Chloride　Fluoride

Hazardous and Solid Waste, Inorganic	*9056*	Nitrate
Nitrite	Phosphate	Sulfate
9060		
Total Organic Carbon (TOC)		
9066		
Phenolics		
9071B		
Oil and Grease Extractable		
9081		
Cation-exchange Capacity		
9095A		
Paint Filter		
9251		
Chloride		
Chapter 7/9014		
Reactive Cyanide		
Chapter 7/9034		
Reactive Sulfide		
Hazardous and Solid Waste, Organic		
8015B		
Diesel range organics (DRO)	Gasoline range organics (GRO)	
8081A		
4,4'-DDD	4,4'-DDE	4,4'-DDT
Alachlor	Aldrin	alpha-BHC
alpha-Chlordane	Atrazine	beta-BHC
Chlordane - not otherwise specified	delta-BHC	Dieldrin
Endosulfan I	Endosulfan II	Endosulfan sulfate
Endrin	Endrin aldehyde	Endrin ketone
gamma-BHC (Lindane)	gamma-Chlordane	Heptachlor
Heptachlor epoxide	Isodrin	Kepone
Methoxychlor	Simazine	Toxaphene
8082		
PCB-1016	PCB-1221	PCB-1232
PCB-1242	PCB-1248	PCB-1254
PCB-1260		
8141A		
Dimethoate	Disulfoton	Famphur
Parathion ethyl	Parathion methyl	Phorate
Sulfotepp	Thionazine (Zinophos)	
8151A		
2,4,5-T	2,4,5-TP (Silvex)	2,4-D
2,4-DB	4-Nitrophenol	Dalapon
Dicamba	Dichloroprop	Dinoseb
Pentachlorophenol	Picloram	

State of Illinois
Environmental Protection Agency
Awards the Certificate of Approval

Certificate No.: 001027

STL Chicago
2417 Bond Street
University Park, IL 60466-3182

Hazardous and Solid Waste, Organic *8260B*

1,1,1,2-Tetrachloroethane	1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane
1,1,2-Trichloroethane	1,1-Dichloroethane	1,1-Dichloroethene
1,1-Dichloropropene	1,2,3-Trichlorobenzene	1,2,3-Trichloropropane
1,2,4-Trichlorobenzene	1,2,4-Trimethylbenzene	1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dibromoethane (EDB)	1,2-Dichlorobenzene	1,2-Dichloroethane
1,2-Dichloropropane	1,3,5-TCB	1,3,5-Trimethylbenzene
1,3-Dichlorobenzene	1,3-Dichloropropane	1,4-Dichlorobenzene
1-Chlorohexane	1-Chlorohexane	2,2-Dichloropropane
2-Butanone (Methyl ethyl ketone, MEK)	2-Chloro-1,3-butadiene (Chloroprene)	2-Chloroethyl vinyl ether
2-Chlorotoluene	2-Hexanone	2-Methyl-1-propanol (Isobutyl alcohol)
2-Methylnaphthalene	2-Nitropropane	4-Chlorotoluene
4-Methyl-2-pentanone (Methyl isobutyl ketone, I	Acetone	Acetonitrile
Acrolein (Propenal)	Acrylonitrile	Allyl chloride
Benzene	Bromobenzene	Bromochloromethane
Bromodichloromethane	Bromoform	Bromomethane
Carbon disulfide	Carbon tetrachloride	Chlorobenzene
Chlorodibromomethane (Dibromochloromethan	Chloroethane	Chloroform
Chloromethane	cis-1,2-Dichloroethene	cis-1,3-Dichloropropene
Dibromomethane	Dichlorodifluoromethane	Dichloromethane (Methylene chloride)
Ethyl acetate	Ethyl ether	Ethyl methacrylate
Ethylbenzene	Hexachlorobutadiene	Isopropyl ether
Isopropylbenzene	Malononitrile	Methacrylonitrile
Methyl ethyl ketone	Methyl iodide (Iodmethane)	Methyl isobutyl ketone
Methyl methacrylate	Methyl-t-butyl ether	m-Xylene
Naphthalene	n-Butylbenzene	n-Propylbenzene
o-Toluidine	o-Xylene	Pentachloroethane
p-Isopropyltoluene	Propionitrile (Ethyl cyanide)	p-Xylene
sec-Butylbenzene	Styrene	tert-Butylbenzene
Tetrachloroethene	Tetrahydrofuran	Toluene
trans-1,2-Dichloroethene	trans-1,3-Dichloropropene	trans-1,4-Dichloro-2-butene
Trichloroethene	Trichlorofluoromethane	Trichlorotrifluoroethane
Trichlorotrifluoromethane	Vinyl acetate	Vinyl chloride
Vinylidene chloride	Xylenes (Total)	

8270C

1,2,4,5-Tetrachlorobenzene	1,2,4-Trichlorobenzene	1,2-Dichlorobenzene
1,2-Diphenylhydrazine	1,3,5-Trinitrobenzene (1,3,5-TNB)	1,3-Dichlorobenzene
1,3-Dinitrobenzene (1,3-DNB)	1,4-Dichlorobenzene	1,4-Dioxane
1,4-Naphthoquinone	1,4-Phenylenediamine	1-Naphthylamine
2,3,4,6-Tetrachlorophenol	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol
2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol
2,4-Dinitrotoluene (2,4-DNT)	2,6-Dichlorophenol	2,6-Dinitrotoluene (2,6-DNT)
2-Acetylaminofluorene	2-Chloronaphthalene	2-Chlorophenol
2-Methylnaphthalene	2-Methylpyridine (2-Picoline)	2-Naphthylamine
2-Nitroaniline	2-Nitrophenol	3,3'-Dichlorobenzidine
3,3'-Dimethylbenzidine	3-Methylcholanthrene	3-Nitroaniline
4,6-Dinitro-2-methylphenol	4-Aminobiphenyl	4-Bromophenyl phenyl ether

Hazardous and Solid Waste, Organic

8270C

4-Chloro-3-methylphenol
4-Chloroaniline
4-Chlorophenyl phenyl ether
4-Nitroaniline
4-Nitrophenol
4-Nitroquinoline-1-oxide
5-Nitro-o-toluidine
7,12-Dimethylbenz(a)anthracene
Acenaphthene
Acenaphthylene
Acetophenone
alpha,alpha-Dimethylphenethylamine
Aniline
Anthracene
Aramite
Benzidine
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perlyene
Benzo(k)fluoranthene
Benzoic acid
Benzyl alcohol
Bis(2-chloroethoxy) methane
Bis(2-chloroethyl) ether
Bis(2-chloroisopropyl) ether
Bis(2-ethylhexyl) phthalate
Butyl benzyl phthalate
Carbazole
Chlorobenzilate
Chrysene
Diallate
Dibenz(a,h)anthracene
Dibenzofuran
Diethyl phthalate
Dimethyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Dinoseb
Diphenylamine
Ethyl methanesulfonate
Fluoranthene
Fluorene
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachloroethane
Hexachlorophene
Hexachloropropene
Indeno(1,2,3-cd) pyrene
Isophorone
Isosafrole
m-Cresol (3-Methylphenol)
m-Dinitrobenzene
Methapyrilene
Methyl methanesulfonate
Naphthalene
Nitrobenzene
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosodi-n-butylamine (N-Nitrosodibutylamin
N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine
N-Nitrosomethylethylamine
N-Nitrosomorpholine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
o-Cresol (2-Methylphenol)
o-Toluidine
Parathion
p-Cresol (4-Methylphenol)
p-Dimethylaminoazobenzene
Pentachlorobenzene
Pentachloronitrobenzene
Pentachlorophenol
Phenacetin
Phenanthrene
Phenol
p-Phenylenediame
Pronamide
Pyrene
Pyridine
Pyridine
Safrole

8310

Acenaphthene
Acenaphthylene
Anthracene
Benzo(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(g,h,i)perylene
Benzo(k)fluoranthene
Chrysene
Dibenz(a,h)anthracene
Fluoranthene
Fluorene
Indeno(1,2,3-cd) pyrene
Naphthalene
Phenanthrene
Pyrene

8330

1,3,5-Trinitrobenzene (1,3,5-TBN)
1,3-Dinitrobenzene (1,3-DNB)
2,4,6-Trinitrotoluene (2,4,6-TNT)
2,4-Dinitrotoluene (2,4-DNT)
2,6-Dinitrotoluene (2,6-DNT)
2-Amino-4,6-dinitrotoluene (2-Am-DNT)
4-Amino-2,6-dinitrotoluene (4-Am-DNT)
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)
m-Nitrotoluene (3-Nitrotoluene, 3-NT)
Nitrobenzene
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
o-Nitrotoluene (2-Nitrotoluene, 2-NT)
p-Nitrotoluene (4-Nitrotoluene, 4-NT)

Wastewater, Inorganic

HACH8000

Chemical Oxygen Demand (COD)

SM3500Cr-D,18Ed

State of Illinois
Environmental Protection Agency
Awards the Certificate of Approval

Certificate No.: 001027

STL Chicago
2417 Bond Street
University Park, IL 60466-3182

Wastewater, Inorganic

SM3500Cr-D,18Ed
Chromium VI

SM4500P-E,18Ed
Orthophosphate (as P)

SM5210B,18Ed
Biochemical Oxygen Demand (BOD)
Carbonaceous Biochemical Oxygen Demand (C

SM5310C,18Ed
Total organic carbon (TOC)

USEPA110.2
Color

USEPA120.1
Specific Conductance

USEPA130.2
Hardness

USEPA150.1
Hydrogen Ion (pH)

USEPA160.1
Residue (TDS)

USEPA160.2
Residue (TSS)

USEPA160.3
Residue (Total)

USEPA160.4
Residue (Volatile)

USEPA1664RA
Oil and Grease

USEPA180.1
Turbidity

USEPA200.7R4.4

Aluminum	Antimony	Arsenic
Barium	Beryllium	Boron
Cadmium	Calcium	Chromium
Cobalt	Copper	Hardness (calc.)
Iron	Lead	Magnesium
Manganese	Molybdenum	Nickel
Potassium	Selenium	Silica
Silver	Sodium	Thallium
Tin	Titanium	Vanadium
Zinc		

USEPA204.2
Antimony

USEPA206.2
Arsenic

USEPA213.2

Wastewater, Inorganic

USEPA213.2

Cadmium

USEPA218.2

Chromium

USEPA239.2

Lead

USEPA245.1

Mercury

USEPA270.2

Selenium

USEPA272.2

Silver

USEPA279.2

Thallium

USEPA300.0R2.1

Bromide	Chloride	Fluoride
Nitrate	Nitrate-Nitrite (sum)	Nitrite
Orthophosphate (as P)	Sulfate	

USEPA305.1

Acidity

USEPA310.1

Alkalinity

USEPA325.2

Chloride

USEPA330.4

Chlorine

USEPA335.1

Cyanide, Amenable

USEPA335.2

Cyanide

USEPA340.2

Fluoride

USEPA350.2

Ammonia

USEPA351.3

Total Kjeldahl Nitrogen

USEPA353.2

Nitrate (total)	Nitrate-Nitrite (sum)

USEPA354.1

Nitrite

USEPA360.1

Oxygen

USEPA365.2

Wastewater, Inorganic

USEPA365.2

Orthophosphate

Phosphorus

USEPA375.4

Sulfate

USEPA376.1

Sulfide

USEPA405.1

Biochemical Oxygen Demand (BOD)

USEPA415.1

Total organic carbon (TOC)

USEPA420.2

Phenolics

Wastewater, Organic

USEPA608

4,4'-DDD	4,4'-DDE	4,4'-DDT
Aldrin	alpha-BHC	beta-BHC
Chlordane	delta-BHC	Dieldrin
Endosulfan I	Endosulfan II	Endosulfan sulfate
Endrin	Endrin aldehyde	gamma-BHC (Lindane)
Heptachlor	Heptachlor epoxide	Methoxychlor
PCB-1016	PCB-1221	PCB-1232
PCB-1242	PCB-1248	PCB-1254
PCB-1260	Toxaphene	

USEPA610

Acenaphthene	Acenaphthylene	Anthracene
Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene
Dibenz(a,h)anthracene	Fluoranthene	Fluorene
Indeno(1,2,3-cd) pyrene	Naphthalene	Phenanthrene
Pyrene		

USEPA624

1,1,1-Trichloroethane	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane
1,1-Dichloroethane	1,1-Dichloroethene	1,2-Dichlorobenzene
1,2-Dichloroethane	1,2-Dichloropropane	1,3-Dichlorobenzene
1,4-Dichlorobenzene	2-Chloroethylvinyl ether	Acrolein
Acrylonitrile	Benzene	Bromodichloromethane
Bromoform	Bromomethane	Carbon tetrachloride
Chlorobenzene	Chloroethane	Chloroform
Chloromethane	cis-1,3-Dichloropropene	Dibromochloromethane
Dichloromethane (Methylene chloride)	Ethylbenzene	Tetrachloroethene
Toluene	trans-1,2-Dichloroethene	trans-1,3-Dichloropropene
Trichloroethene	Trichlorofluoromethane	Vinyl chloride
Xylenes (total)		

USEPA625

1,2,4-Trichlorobenzene	1,2-Dichlorobenzene	1,3-Dichlorobenzene

State of Illinois
Environmental Protection Agency
Awards the Certificate of Approval

Certificate No.: 001027

STL Chicago
2417 Bond Street
University Park, IL 60466-3182

Wastewater, Organic	*USEPA625*	1,4-Dichlorobenzene
2,2-Oxybis(1-chloropropane)	2,4,5-Trichlorophenol	2,4,6-Trichlorophenol
2,4-Dichlorophenol	2,4-Dimethylphenol	2,4-Dinitrophenol
2,4-Dinitrotoluene (2,4-DNT)	2,6-Dinitrotoluene (2,6-DNT)	2-Chloronaphthalene
2-Chlorophenol	2-Methyl-4,6-dinitrophenol	2-Nitrophenol
3,3'-Dichlorobenzidine	4-Bromophenyl phenyl ether	4-Chloro-3-methylphenol
4-Chlorophenyl phenyl ether	4-Nitrophenol	Acenaphthene
Acenaphthylene	Anthracene	Benzidine
Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene
Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Benzyl butyl phthalate
Bis(2-chloroethoxy) methane	Bis(2-chloroethyl) ether	Bis(2-ethylhexyl) phthalate
Chrysene	Dibenz(a,h)anthracene	Diethyl phthalate
Dimethyl phthalate	Di-n-butyl phthalate	Di-n-octyl phthalate
Fluoranthene	Fluorene	Hexachlorobenzene
Hexachlorobutadiene	Hexachlorocyclopentadiene	Hexachloroethane
Indeno(1,2,3-cd) pyrene	Isophorone	Naphthalene
Nitrobenzene	N-Nitrosodimethylamine	N-Nitrosodi-n-propylamine
N-Nitrosodiphenylamine	Pentachlorophenol	Phenanthrene
Phenol	Pyrene	

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
12565 WEST CENTER ROAD
OMAHA NE 68144-3869

REPLY TO
ATTENTION OF

September 29, 2004

Hazardous, Toxic and Radioactive Waste
Center of Expertise

Pamela Schemmer
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Dear Ms. Schemmer:

This correspondence addresses the ongoing validation status of STL Sacramento of West Sacramento, CA by the U.S. Army Corps of Engineers (USACE) for chemical analysis in support of the Hazardous, Toxic and Radioactive Waste Program.

Your laboratory is now validated for the parameters listed below:

METHODS	PARAMETERS	MATRIX(1)
IO-3/6020/TSP(2)	TAL Metals(3)	Air(4)
6010B/7000A(5)	TAL Metals(3)	Water(6)
6010B/7000A(5)	TAL Metals(3)	Solids(6)
6020/7470A	TAL Metals(3)	Water(6)
6020/7471A	TAL Metals(3)	Solids(6)
8015M	Total Petroleum Hydrocarbons – Gasoline Range Organics	Water(6)
8015M	Total Petroleum Hydrocarbons – Gasoline Range Organics	Solids(6)
8015M	Total Petroleum Hydrocarbons – Diesel Range Organics	Water(6)
8015M	Total Petroleum Hydrocarbons – Diesel Range Organics	Solids(6)
8021B	Benzene, Toluene, Ethylbenzene, and Xylenes	Water(6)
8021B	Benzene, Toluene, Ethylbenzene, and Xylenes	Solids(4)
8081A	Organochlorine Pesticides	Water(6)
8081A	Organochlorine Pesticides	Solids(6)
TO-4A/1668A(7)	Polychlorinated Biphenyls-Congeners	Air(4)
8082	Polychlorinated Biphenyls	Water(6)
8082	Polychlorinated Biphenyls	Solids(6)
8151A	Chlorinated herbicides	Water(6)
TO-14A/15(8)	Volatile Organics	Air(4)
8260B	Volatile Organics	Water(6)
8260B	Volatile Organics	Solids(6)
8270C	Semivolatile Organics	Water(6)
8270C	Semivolatile Organics	Solids(6)

TO-13A[8]	Polynuclear Aromatic Hydrocarbons	Air[4]
8270C SIM	Polynuclear Aromatic Hydrocarbons	Water[4]
8270C SIM	Polynuclear Aromatic Hydrocarbons	Solids[4]
TO-9A[8]	Dioxins	Air[4]
8280A	Dioxins	Water[4]
8280A	Dioxins	Solids[6]
8290	Dioxins	Water[6]
8290	Dioxins	Solids[6]
8310	Polynuclear Aromatic Hydrocarbons	Water[6]
8310	Polynuclear Aromatic Hydrocarbons	Solids[6]
8321A	Explosives	Water[6]
8321A	Explosives	Solids[4]
8330	Explosives	Water[6]
8330	Explosives	Solids[4]
9012A	Cyanide	Water[6]
9012A	Cyanide	Solids[6]
314.0	Perchlorate	Water[6]
314.0	Perchlorate	Solids[4]
300.0/9056	Anions[9]	Water[6]
300.0/9056	Anions[9]	Solids[6]

Remarks: (1) "Solids" includes soils, sediments, and solid waste.

(2) TAL metals in collected total suspended particulate (TSP) matter from ambient air.

(3) TAL Metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

(4) Approval for this parameter is based on review of SOPs and/or evaluation of PT results for other matrices.

(5) Method 7000A includes only Methods 7470A and 7471A for mercury in water and soil, respectively.

(6) The laboratory has demonstrated acceptable proficiency for the parameters/matrix/methods by successful analysis of proficiency testing (PT) samples from a NELAC accredited PT provider(s) or other reliable PT providers if a NELAC accredited PT provider is not available.

(7) Samples collected on PUF/XAD cartridge, followed by solvent extraction.

(8) Analysis of whole air sample collected in specially treated canister.

(9) Anions: chloride, fluoride, sulfate, nitrate, and orthophosphate.

Based on acceptable past performance of your laboratory, the validation of your laboratory is hereby extended from September 30, 2004 to March 31, 2005 to provide time to complete the revalidation process.

The USACE reserves the right to conduct additional laboratory inspections or to suspend validation status for any or all of the listed parameters if deemed necessary. It should be noted that your laboratory may not subcontract USACE analytical work to any other laboratory location without the approval of this office. This laboratory validation does not guarantee the delivery of any analytical samples from a USACE Contracting Officer Representative.

Any questions or comments can be directed to Kevin Coats at (402) 697-2563. General questions regarding laboratory validation may be directed to the Laboratory Validation Coordinator at (402) 697-2574.

Sincerely,

Marcia C. Davies

Marcia C. Davies, Ph.D.
Director, USACE Hazardous,
Toxic and Radioactive Waste
Center of Expertise

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
NELAP - RECOGNIZED

ACCREDITATION

Is hereby granted to

STL - SACRAMENTO

880 RIVERSIDE PARKWAY

WEST SACRAMENTO, CA 95605

Scope of accreditation is limited to the
"NELAP Fields of Accreditation"
which accompanies this Certificate.

Continued accredited status depends on successful
ongoing participation in the program.

This Certificate is granted in accordance with provisions of
Section 100825, et seq. of the Health and Safety Code.

Certificate No:	**01119CA**
Expiration Date:	**01/31/2006**
Effective Date:	**01/31/2005**

Berkeley, California
subject to forfeiture or revocation.

George C. Kulasingam, Ph.D.
Program Chief
Environmental Laboratory Accreditation Program

CALIFORNIA DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM - NELAP RECOGNIZED
NELAP Fields of Accreditation

STL - SACRAMENTO **Lab Phone** (916) 373-5600

880 RIVERSIDE PARKWAY
WEST SACRAMENTO, CA 95605

Certificate No: 01119CA Renew Date: 1/31/2006 **INTERIM**

102 - Inorganic Chemistry of Drinking Water

102.045	001	EPA 314.0	Perchlorate

105 - Semi-volatile Organic Chemistry of Drinking Water

105.230	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)

108 - Inorganic Chemistry of Wastewater

108.020	001	EPA 120.1	Conductivity
108.040	001	EPA 130.2	Hardness
108.050	001	EPA 150.1	pH
108.060	001	EPA 160.1	Residue, Filterable
108.070	001	EPA 160.2	Residue, Non-filterable
108.080	001	EPA 160.3	Residue, Total
108.090	001	EPA 160.4	Residue, Volatile
108.100	001	EPA 160.5	Residue, Settleable
108.110	001	EPA 180.1	Turbidity
108.112	002	EPA 200.7	Calcium
108.112	004	EPA 200.7	Magnesium
108.112	005	EPA 200.7	Potassium
108.112	006	EPA 200.7	Silica
108.112	007	EPA 200.7	Sodium
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite, Total
108.120	007	EPA 300.0	Phosphate, Ortho
108.120	008	EPA 300.0	Sulfate
108.140	001	EPA 310.1	Alkalinity
108.181	001	EPA 335.2	Cyanide, Total
108.191	001	EPA 340.2	Fluoride
108.200	001	EPA 350.1	Ammonia
108.211	001	EPA 351.2	Kjeldahl Nitrogen
108.231	001	EPA 353.2	Nitrate calc.
108.232	001	EPA 353.2	Nitrate-nitrite, Total
108.233	001	EPA 353.2	Nitrite
108.264	001	EPA 365.3	Phosphate, Ortho
108.265	001	EPA 365.3	Phosphorus, Total
108.291	001	EPA 376.2	Sulfide
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.340	001	EPA 415.1	Total Organic Carbon
108.362	001	EPA 420.4	Phenols, Total

As of 2/1/2005 , this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

108.380	001	EPA 1664	Oil and Grease
108.410	001	SM2320B	Alkalinity
108.420	001	SM2340B	Hardness (calc.)
108.421	001	SM2340C	Hardness
108.441	001	SM2540C	Residue, Filterable
108.472	001	SM4500-CN E	Cyanide, Total
108.473	001	SM4500-CN G	Cyanide, amenable
108.611	001	SM5310C	Total Organic Carbon

109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	007	EPA 200.7	Cadmium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	019	EPA 200.7	Selenium
109.010	021	EPA 200.7	Silver
109.010	023	EPA 200.7	Thallium
109.010	024	EPA 200.7	Tin
109.010	025	EPA 200.7	Titanium
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc

111 - Semi-volatile Organic Chemistry of Wastewater

111.110	001	EPA 1613	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	
111.110	002	EPA 1613	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	
111.110	003	EPA 1613	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	
111.110	004	EPA 1613	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	
111.110	005	EPA 1613	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	
111.110	006	EPA 1613	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	
111.110	007	EPA 1613	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	
111.110	008	EPA 1613	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	
111.110	009	EPA 1613	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	
111.110	010	EPA 1613	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	
111.110	011	EPA 1613	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	
111.110	012	EPA 1613	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	
111.110	013	EPA 1613	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	
111.110	014	EPA 1613	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	
111.110	015	EPA 1613	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	
111.110	016	EPA 1613	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	
111.110	017	EPA 1613	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	
111.110	018	EPA 1613	Total TCDD	
111.110	019	EPA 1613	Total PeCDD	
111.110	020	EPA 1613	Total HxCDD	
111.110	021	EPA 1613	Total HpCDD	
111.110	022	EPA 1613	Total TCDF	
111.110	023	EPA 1613	Total PeCDF	
111.110	024	EPA 1613	Total HxCDF	
111.110	025	EPA 1613	Total HpCDF	

114 - Inorganic Chemistry of Hazardous Waste

114.010	001	EPA 6010B	Antimony	
114.010	002	EPA 6010B	Arsenic	
114.010	003	EPA 6010B	Barium	
114.010	004	EPA 6010B	Beryllium	
114.010	005	EPA 6010B	Cadmium	
114.010	006	EPA 6010B	Chromium	
114.010	007	EPA 6010B	Cobalt	
114.010	008	EPA 6010B	Copper	
114.010	009	EPA 6010B	Lead	
114.010	010	EPA 6010B	Molybdenum	
114.010	011	EPA 6010B	Nickel	
114.010	012	EPA 6010B	Selenium	
114.010	013	EPA 6010B	Silver	
114.010	014	EPA 6010B	Thallium	
114.010	015	EPA 6010B	Vanadium	
114.010	016	EPA 6010B	Zinc	
114.010	026	EPA 6010B	Silica	Aqueous
114.010	027	EPA 6010B	Sodium	
114.020	001	EPA 6020	Antimony	
114.020	002	EPA 6020	Arsenic	
114.020	003	EPA 6020	Barium	

114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel
114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.103	001	EPA 7196A	Chromium (VI)
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.221	001	EPA 9012A	Cyanide, Total
114.240	001	EPA 9040	pH
114.241	001	EPA 9045	pH
114.250	001	EPA 9056	Fluoride
114.291	001	EPA 340.2	Fluoride

115 - Extraction Test of Hazardous Waste

115.021	001	EPA 1311	TCLP Inorganics
115.022	001	EPA 1311	TCLP Extractables
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)

116 - Volatile Organic Chemistry of Hazardous Waste

116.030	001	EPA 8015B	Gasoline-range Organics
116.040	002	EPA 8021B	Benzene
116.040	039	EPA 8021B	Ethylbenzene
116.040	041	EPA 8021B	Methyl tert-butyl Ether (MTBE)
116.040	047	EPA 8021B	Toluene
116.040	056	EPA 8021B	Xylenes, Total
116.080	001	EPA 8260B	Acetone
116.080	002	EPA 8260B	Acetonitrile
116.080	003	EPA 8260B	Acrolein
116.080	004	EPA 8260B	Acrylonitrile
116.080	006	EPA 8260B	Allyl Chloride
116.080	007	EPA 8260B	Benzene
116.080	010	EPA 8260B	Bromochloromethane
116.080	011	EPA 8260B	Bromodichloromethane
116.080	012	EPA 8260B	Bromoform
116.080	013	EPA 8260B	Bromomethane
116.080	015	EPA 8260B	Carbon Disulfide
116.080	016	EPA 8260B	Carbon Tetrachloride
116.080	018	EPA 8260B	Chlorobenzene
116.080	019	EPA 8260B	Chloroethane
116.080	020	EPA 8260B	2-Chloroethyl Vinyl Ether
116.080	021	EPA 8260B	Chloroform

116.080	022	EPA 8260B	Chloromethane
116.080	023	EPA 8260B	Chloroprene
116.080	026	EPA 8260B	Dibromochloromethane
116.080	027	EPA 8260B	Dibromochloropropane
116.080	028	EPA 8260B	1,2-Dibromoethane
116.080	029	EPA 8260B	Dibromofluoromethane
116.080	030	EPA 8260B	Dibromomethane
116.080	031	EPA 8260B	1,2-Dichlorobenzene
116.080	032	EPA 8260B	1,3-Dichlorobenzene
116.080	033	EPA 8260B	1,4-Dichlorobenzene
116.080	035	EPA 8260B	trans-1,4-Dichloro-2-butene
116.080	036	EPA 8260B	Dichlorodifluoromethane
116.080	037	EPA 8260B	1,1-Dichloroethane
116.080	038	EPA 8260B	1,2-Dichloroethane
116.080	039	EPA 8260B	1,1-Dichloroethene
116.080	040	EPA 8260B	trans-1,2-Dichloroethene
116.080	041	EPA 8260B	cis-1,2-Dichloroethene
116.080	042	EPA 8260B	1,2-Dichloropropane
116.080	043	EPA 8260B	1,3-Dichloropropane
116.080	044	EPA 8260B	2,2-Dichloropropane
116.080	045	EPA 8260B	1,1-Dichloropropene
116.080	046	EPA 8260B	cis-1,3-Dichloropropene
116.080	047	EPA 8260B	trans-1,3-Dichloropropene
116.080	050	EPA 8260B	1,4-Dioxane
116.080	053	EPA 8260B	Ethylbenzene
116.080	055	EPA 8260B	Ethyl Methacrylate
116.080	056	EPA 8260B	Hexachlorobutadiene
116.080	058	EPA 8260B	2-Hexanone (MBK)
116.080	059	EPA 8260B	Iodomethane
116.080	060	EPA 8260B	Isobutyl Alcohol
116.080	062	EPA 8260B	Methacrylonitrile
116.080	064	EPA 8260B	Methyl tert-butyl Ether (MTBE)
116.080	065	EPA 8260B	Methylene Chloride
116.080	066	EPA 8260B	Methyl Ethyl Ketone
116.080	067	EPA 8260B	Methyl Methacrylate
116.080	068	EPA 8260B	4-Methyl-2-pentanone (MIBK)
116.080	069	EPA 8260B	Naphthalene
116.080	078	EPA 8260B	Propionitrile
116.080	081	EPA 8260B	1,1,1,2-Tetrachloroethane
116.080	082	EPA 8260B	1,1,2,2-Tetrachloroethane
116.080	083	EPA 8260B	Tetrachloroethene
116.080	084	EPA 8260B	Toluene
116.080	086	EPA 8260B	1,2,3-Trichlorobenzene
116.080	087	EPA 8260B	1,2,4-Trichlorobenzene
116.080	088	EPA 8260B	1,1,1-Trichloroethane
116.080	089	EPA 8260B	1,1,2-Trichloroethane
116.080	090	EPA 8260B	Trichloroethene
116.080	091	EPA 8260B	Trichlorofluoromethane

116.080	092	EPA 8260B	1,2,3-Trichloropropane
116.080	093	EPA 8260B	Vinyl Acetate
116.080	094	EPA 8260B	Vinyl Chloride
116.080	095	EPA 8260B	Xylenes, Total
116.080	096	EPA 8260B	tert-Amyl Methyl Ether (TAME)
116.080	097	EPA 8260B	tert-Butyl Alcohol (TBA)
116.080	098	EPA 8260B	Ethyl tert-butyl Ether (ETBE)
116.080	099	EPA 8260B	Bromobenzene
116.080	100	EPA 8260B	n-Butylbenzene
116.080	101	EPA 8260B	sec-Butylbenzene
116.080	102	EPA 8260B	tert-Butylbenzene
116.080	103	EPA 8260B	2-Chlorotoluene
116.080	104	EPA 8260B	4-Chlorotoluene
116.080	105	EPA 8260B	Isopropylbenzene
116.080	106	EPA 8260B	N-propylbenzene
116.080	107	EPA 8260B	Styrene
116.080	108	EPA 8260B	1,2,4-Trimethylbenzene
116.080	109	EPA 8260B	1,3,5-Trimethylbenzene
116.110	001	LUFT	Total Petroleum Hydrocarbons - Gasoline
117 - Semi-volatile Organic Chemistry of Hazardous Waste			
117.010	001	EPA 8015B	Diesel-range Total Petroleum Hydrocarbons
117.016	001	LUFT	Diesel-range Total Petroleum Hydrocarbons
117.110	001	EPA 8270C	Acenaphthene
117.110	002	EPA 8270C	Acenaphthylene
117.110	003	EPA 8270C	Acetophenone
117.110	004	EPA 8270C	2-Acetylaminofluorene
117.110	006	EPA 8270C	4-Aminobiphenyl
117.110	007	EPA 8270C	Aniline
117.110	008	EPA 8270C	Anthracene
117.110	009	EPA 8270C	Aramite
117.110	010	EPA 8270C	Benzidine
117.110	011	EPA 8270C	Benz(a)anthracene
117.110	012	EPA 8270C	Benzo(b)fluoranthene
117.110	013	EPA 8270C	Benzo(k)fluoranthene
117.110	014	EPA 8270C	Benzo(g,h,i)perylene
117.110	015	EPA 8270C	Benzo(a)pyrene
117.110	016	EPA 8270C	Benzoic Acid
117.110	018	EPA 8270C	Benzyl Alcohol
117.110	019	EPA 8270C	Benzyl Butyl Phthalate
117.110	020	EPA 8270C	Bis(2-chloroethoxy)methane
117.110	021	EPA 8270C	Bis(2-chloroethyl) Ether
117.110	022	EPA 8270C	Bis(2-chloroisopropyl) Ether
117.110	023	EPA 8270C	Di(2-ethylhexyl) Phthalate
117.110	024	EPA 8270C	4-Bromophenyl Phenyl Ether
117.110	025	EPA 8270C	Carbazole
117.110	026	EPA 8270C	4-Chloroaniline
117.110	027	EPA 8270C	4-Chloro-3-methylphenol
117.110	028	EPA 8270C	1-Chloronaphthalene

117.110	029	EPA 8270C	2-Chloronaphthalene
117.110	030	EPA 8270C	2-Chlorophenol
117.110	031	EPA 8270C	4-Chlorophenyl Phenyl Ether
117.110	032	EPA 8270C	Chrysene
117.110	035	EPA 8270C	Dibenz(a,j)acridine
117.110	036	EPA 8270C	Dibenz(a,h)anthracene
117.110	037	EPA 8270C	Dibenzofuran
117.110	039	EPA 8270C	1,2-Dichlorobenzene
117.110	040	EPA 8270C	1,3-Dichlorobenzene
117.110	041	EPA 8270C	1,4-Dichlorobenzene
117.110	042	EPA 8270C	3,3'-Dichlorobenzidine
117.110	043	EPA 8270C	2,4-Dichlorophenol
117.110	044	EPA 8270C	2,6-Dichlorophenol
117.110	045	EPA 8270C	Diethyl Phthalate
117.110	050	EPA 8270C	p-Dimethylaminoazobenzene
117.110	051	EPA 8270C	7,12-Dimethylbenz(a)anthracene
117.110	052	EPA 8270C	a,a-Dimethylphenethylamine
117.110	053	EPA 8270C	2,4-Dimethylphenol
117.110	054	EPA 8270C	Dimethyl Phthalate
117.110	055	EPA 8270C	Di-n-butyl phthalate
117.110	056	EPA 8270C	Di-n-octyl phthalate
117.110	057	EPA 8270C	1,2-Dinitrobenzene
117.110	058	EPA 8270C	1,3-Dinitrobenzene
117.110	059	EPA 8270C	1,4-Dinitrobenzene
117.110	060	EPA 8270C	2,4-Dinitrophenol
117.110	061	EPA 8270C	2,4-Dinitrotoluene
117.110	062	EPA 8270C	2,6-Dinitrotoluene
117.110	063	EPA 8270C	Diphenylamine
117.110	064	EPA 8270C	1,2-Diphenylhydrazine
117.110	066	EPA 8270C	Ethyl Methanesulfonate
117.110	067	EPA 8270C	Fluoranthene
117.110	068	EPA 8270C	Fluorene
117.110	069	EPA 8270C	Hexachlorobenzene
117.110	070	EPA 8270C	Hexachlorobutadiene
117.110	071	EPA 8270C	Hexachlorocyclopentadiene
117.110	072	EPA 8270C	Hexachloroethane
117.110	074	EPA 8270C	Hexachloropropene
117.110	075	EPA 8270C	Indeno(1,2,3-c,d)pyrene
117.110	076	EPA 8270C	Isophorone
117.110	077	EPA 8270C	Isosafrole
117.110	079	EPA 8270C	3-Methylcholanthrene
117.110	080	EPA 8270C	2-Methyl-4,6-dinitrophenol
117.110	082	EPA 8270C	Methyl Methanesulfonate
117.110	083	EPA 8270C	2-Methylnaphthalene
117.110	084	EPA 8270C	2-Methylphenol
117.110	085	EPA 8270C	3-Methylphenol
117.110	086	EPA 8270C	4-Methylphenol
117.110	087	EPA 8270C	Naphthalene

117.110	088	EPA 8270C	1,4-Naphthoquinone
117.110	089	EPA 8270C	1-Naphthylamine
117.110	090	EPA 8270C	2-Naphthylamine
117.110	092	EPA 8270C	2-Nitroaniline
117.110	093	EPA 8270C	3-Nitroaniline
117.110	094	EPA 8270C	4-Nitroaniline
117.110	095	EPA 8270C	Nitrobenzene
117.110	096	EPA 8270C	2-Nitrophenol
117.110	097	EPA 8270C	4-Nitrophenol
117.110	098	EPA 8270C	N-nitrosodi-n-butylamine
117.110	099	EPA 8270C	N-nitrosodiethylamine
117.110	100	EPA 8270C	N-nitrosodimethylamine
117.110	101	EPA 8270C	N-nitrosodi-n-propylamine
117.110	102	EPA 8270C	N-nitrosodiphenylamine
117.110	103	EPA 8270C	N-nitrosomethylethylamine
117.110	104	EPA 8270C	N-nitrosomorpholine
117.110	105	EPA 8270C	N-nitrosopiperidine
117.110	106	EPA 8270C	N-nitrosopyrrolidine
117.110	107	EPA 8270C	5-Nitro-o-toluidine
117.110	108	EPA 8270C	Pentachlorobenzene
117.110	109	EPA 8270C	Pentachloronitrobenzene
117.110	110	EPA 8270C	Pentachlorophenol
117.110	111	EPA 8270C	Phenacetin
117.110	112	EPA 8270C	Phenanthrene
117.110	113	EPA 8270C	Phenol
117.110	114	EPA 8270C	1,4-Phenylenediamine
117.110	116	EPA 8270C	2-Picoline
117.110	117	EPA 8270C	Pronamide
117.110	119	EPA 8270C	Pyrene
117.110	120	EPA 8270C	Pyridine
117.110	122	EPA 8270C	Safrole
117.110	124	EPA 8270C	1,2,4,5-Tetrachlorobenzene
117.110	125	EPA 8270C	2,3,4,6-Tetrachlorophenol
117.110	128	EPA 8270C	o-Toluidine
117.110	129	EPA 8270C	1,2,4-Trichlorobenzene
117.110	130	EPA 8270C	2,4,5-Trichlorophenol
117.110	131	EPA 8270C	2,4,6-Trichlorophenol
117.110	132	EPA 8270C	1,3,5-Trinitrobenzene
117.111	015	EPA 8270C	Chlorobenzilate
117.111	021	EPA 8270C	Diallate
117.111	025	EPA 8270C	Dimethoate
117.111	039	EPA 8270C	Isodrin
117.111	054	EPA 8270C	Parathion Ethyl
117.111	055	EPA 8270C	Parathion Methyl
117.111	056	EPA 8270C	Phorate
117.111	058	EPA 8270C	Sulfotepp
117.111	061	EPA 8270C	O,O,O-triethyl Phosphorothioate
117.111	062	EPA 8270C	Trifluralin

117.120	001	EPA 8280A	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
117.120	002	EPA 8280A	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
117.120	003	EPA 8280A	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.120	004	EPA 8280A	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.120	005	EPA 8280A	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
117.120	006	EPA 8280A	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
117.120	007	EPA 8280A	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
117.120	008	EPA 8280A	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
117.120	009	EPA 8280A	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
117.120	010	EPA 8280A	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.120	011	EPA 8280A	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
117.120	012	EPA 8280A	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.120	013	EPA 8280A	Total TCDD
117.120	014	EPA 8280A	Total PeCDD
117.120	015	EPA 8280A	Total HxCDD
117.120	016	EPA 8280A	Total TCDF
117.120	017	EPA 8280A	Total PeCDF
117.120	018	EPA 8280A	Total HxCDF
117.120	019	EPA 8280A	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
117.120	020	EPA 8280A	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
117.120	021	EPA 8280A	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
117.120	022	EPA 8280A	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
117.120	023	EPA 8280A	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
117.120	024	EPA 8280A	Total HpCDD
117.120	025	EPA 8280A	Total HpCDF
117.130	001	EPA 8290	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)
117.130	002	EPA 8290	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)
117.130	003	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	004	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	005	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)
117.130	006	EPA 8290	2,3,7,8-Tetrachlorodibenzofuran (TCDF)
117.130	007	EPA 8290	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	008	EPA 8290	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)
117.130	009	EPA 8290	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	010	EPA 8290	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	011	EPA 8290	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)
117.130	012	EPA 8290	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)
117.130	013	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)
117.130	014	EPA 8290	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)
117.130	015	EPA 8290	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)
117.130	016	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)
117.130	017	EPA 8290	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)
117.140	001	EPA 8310	Acenaphthene
117.140	002	EPA 8310	Acenaphthylene
117.140	003	EPA 8310	Anthracene
117.140	004	EPA 8310	Benz(a)anthracene
117.140	005	EPA 8310	Benzo(a)pyrene
117.140	006	EPA 8310	Benzo(b)fluoranthene

117.140	007	EPA 8310	Benzo(k)fluoranthene
117.140	008	EPA 8310	Benzo(g,h,i)perylene
117.140	009	EPA 8310	Chrysene
117.140	010	EPA 8310	Dibenz(a,h)anthracene
117.140	011	EPA 8310	Fluoranthene
117.140	012	EPA 8310	Fluorene
117.140	013	EPA 8310	Indeno(1,2,3-c,d)pyrene
117.140	014	EPA 8310	Naphthalene
117.140	015	EPA 8310	Phenanthrene
117.140	016	EPA 8310	Pyrene
117.170	001	EPA 8330	4-Amino-2,6-dinitrotoluene
117.170	002	EPA 8330	2-Amino-4,6-dinitrotoluene
117.170	003	EPA 8330	1,3-Dinitrobenzene
117.170	004	EPA 8330	2,4-Dinitrotoluene
117.170	005	EPA 8330	2,6-Dinitrotoluene
117.170	006	EPA 8330	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)
117.170	007	EPA 8330	Methyl-2,4,6-trinitrophenylnitramine
117.170	008	EPA 8330	Nitrobenzene
117.170	009	EPA 8330	2-Nitrotoluene
117.170	010	EPA 8330	3-Nitrotoluene
117.170	011	EPA 8330	4-Nitrotoluene
117.170	012	EPA 8330	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine
117.170	013	EPA 8330	1,3,5-Trinitrobenzene
117.170	014	EPA 8330	2,4,6-Trinitrotoluene
117.210	001	EPA 8081A	Aldrin
117.210	002	EPA 8081A	a-BHC
117.210	003	EPA 8081A	b-BHC
117.210	004	EPA 8081A	d-BHC
117.210	005	EPA 8081A	g-BHC (Lindane)
117.210	007	EPA 8081A	a-Chlordane
117.210	008	EPA 8081A	g-Chlordane
117.210	009	EPA 8081A	Chlordane (tech.)
117.210	010	EPA 8081A	Chlorobenzilate
117.210	013	EPA 8081A	4,4'-DDD
117.210	014	EPA 8081A	4,4'-DDE
117.210	015	EPA 8081A	4,4'-DDT
117.210	016	EPA 8081A	Diallate
117.210	020	EPA 8081A	Dieldrin
117.210	021	EPA 8081A	Endosulfan I
117.210	022	EPA 8081A	Endosulfan II
117.210	023	EPA 8081A	Endosulfan Sulfate
117.210	024	EPA 8081A	Endrin
117.210	025	EPA 8081A	Endrin Aldehyde
117.210	026	EPA 8081A	Endrin Ketone
117.210	027	EPA 8081A	Heptachlor
117.210	028	EPA 8081A	Heptachlor Epoxide
117.210	031	EPA 8081A	Isodrin
117.210	033	EPA 8081A	Methoxychlor

117.210	039	EPA 8081A	Toxaphene
117.220	001	EPA 8082	PCB-1016
117.220	002	EPA 8082	PCB-1221
117.220	003	EPA 8082	PCB-1232
117.220	004	EPA 8082	PCB-1242
117.220	005	EPA 8082	PCB-1248
117.220	006	EPA 8082	PCB-1254
117.220	007	EPA 8082	PCB-1260

FLORIDA DEPARTMENT OF
HEALTH

Jeb Bush
Governor

John O. Agwunobi, M.D., M.B.A.
Secretary

March 7, 2005
I. D. # E87570

CERTIFIED MAIL NUMBER 7001 2510 0002 7549 1934

Eric Redman
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 96505

Dear Laboratory Director:

In the e-mail dated March 5, 2005, authorized personnel at your laboratory indicated that certification for the following was to be voluntarily relinquished:

Solid and Chemical Materials

EPA 1310	EP-TOX Extraction
EPA 8021	1,1,2,2-Tetrachloroethane
EPA 8021	1,1,2-Trichloroethane
EPA 8021	1,1-Dichloroethane
EPA 8021	1,1-Dichloroethylene
EPA 8021	1,2-Dichlorobenzene
EPA 8021	1,2-Dichloroethane
EPA 8021	1,2-Dichloropropane
EPA 8021	1,3-Dichlorobenzene
EPA 8021	1,4-Dichlorobenzene
EPA 8021	2-Chloroethyl vinyl ether
EPA 8021	Bromochloromethane
EPA 8021	Bromodichloromethane
EPA 8021	Bromoform
EPA 8021	Carbon Tetrachloride
EPA 8021	Chlorobenzene
EPA 8021	Chloroethane
EPA 8021	Chloroform
EPA 8021	cis-1,2-Dichloroethylene
EPA 8021	cis-1,3-Dichloropropene
EPA 8021	Dibromochloromethane
EPA 8021	Dichlorodifluoromethane
EPA 8021	Methyl bromide
EPA 8021	Methyl chloride
EPA 8021	Methylene chloride
EPA 8021	Tetrachloroethylene
EPA 8021	trans-1,2-Dichloroethylene
EPA 8021	trans-1,3-Dichloropropylene
EPA 8021	Trichloroethene
EPA 8021	Trichlorofluoromethane
EPA 8021	Vinyl chloride
EPA 8151	2,4-DB
EPA 8151	Dalapon
EPA 8151	Dichloroprop
EPA 8151	Dinoseb
EPA 8151	MCPA

EPA 8151	MCPP
EPA 8270	5,5-Diphenylhydantoin
EPA 8270	Benzo(j)fluoranthene
EPA 8270	Dinoseb

Non-Potable Water

EPA 300.0	Fluoride
EPA 335.4	Cyanide

Please be advised that the Department of Health has made the necessary changes to the scope of your laboratory's certification final as of March 5, 2005. The attached Laboratory Scope of Accreditation reflects the Fields of Accreditation for which the laboratory is now certified.

If there are any questions regarding this action, please contact the Environmental Laboratory Certification Program immediately at 904-791-1599 or e-mail me at steve_arms@doh.state.fl.us.

Sincerely,

Stephen A. Arms

Stephen A. Arms
Administrator
Environmental Laboratory Certification Program

SAA\nr

Enclosure: Laboratory Scope of Accreditation

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that the foregoing notice was sent to STL Sacramento via United States Certified Mail this 8th day of March 2005.

Signature

Laboratory Scope of Accreditation

THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE

State Laboratory ID: E87570 **EPA Lab Code:** CA00044 (916) 373-5600

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Drinking Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 1613	Dioxin	NELAP	9/24/2001

THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE

State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8-Hxcdd	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8-Hxcdf	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,6,7,8-Hxcdd	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,6,7,8-Hxcdf	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8,9-Hxcdd	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8,9-Hxcdf	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8-Pecdd	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8-Pecdf	EPA 1613	Extractable Organics	NELAP	9/24/2001
1,3,5-Trinitrobenzene (1,3,5-TNB)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
1,3-Dinitrobenzene (1,3-DNB)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
1-Methylnaphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
1-Methylphenanthrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ 197)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ 198)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ 173)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE

State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3'-Tetrachlorobiphenyl (BZ 40)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ 185)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,6-Hexachlorobiphenyl (BZ 147)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

Laboratory Scope of Accreditation

THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE

State Laboratory ID: **E87570** **EPA Lab Code:** **CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: **Non-Potable Water**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,6-Pentachlorobiphenyl (BZ 88)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',6-Pentachlorobiphenyl (BZ 91)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5',6-Pentachlorobiphenyl (BZ 95)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,6-Tetrachlorobiphenyl (BZ 45)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3-Trichlorobiphenyl (BZ 16)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',6-Pentachlorobiphenyl (BZ 100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4'-Tetrachlorobiphenyl (BZ 47)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,5,6'-Pentachlorobiphenyl (BZ 102)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,5',6-Pentachlorobiphenyl (BZ 103)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,6-Tetrachlorobiphenyl (BZ 50)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4-Trichlorobiphenyl (BZ 17)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',5,6'-Tetrachlorobiphenyl (BZ 53)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',6-Trichlorobiphenyl (BZ 19)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

Laboratory Scope of Accreditation

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State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ 193)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4-Tetrachlorobiphenyl (BZ 55)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',5',6-Pentachlorobiphenyl (BZ 113)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',5-Tetrachlorobiphenyl (BZ 57)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',5'-Tetrachlorobiphenyl (BZ 58)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',6-Tetrachlorobiphenyl (BZ 59)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',5',6-Hexachlorobiphenyl (BZ 168)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2',3,4,4',5-Pentachlorobiphenyl	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,4',6-Pentachlorobiphenyl (BZ 115)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',6-Pentachlorobiphenyl (BZ 119)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4',5,5'-Pentachlorobiphenyl (BZ 124)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4',5-Tetrachlorobiphenyl (BZ 63)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,5-Tetrachlorobiphenyl (BZ 67)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4',5-Tetrachlorobiphenyl (BZ 70)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,6,7,8-Hxcdf	EPA 1613	Extractable Organics	NELAP	9/24/2001
2,3,4',6-Tetrachlorobiphenyl (BZ 64)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

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State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3',4,6-Tetrachlorobiphenyl (BZ 69)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4',6-Tetrachlorobiphenyl (BZ 71)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,7,8-Pecdf	EPA 1613	Extractable Organics	NELAP	9/24/2001
2,3,4'-Trichlorobiphenyl (BZ 22)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4-Trichlorobiphenyl (BZ 25)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4'-Trichlorobiphenyl (BZ 33)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,5,6-Tetrachlorobiphenyl (BZ 65)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',5',6-Tetrachlorobiphenyl (BZ 73)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,5-Trichlorobiphenyl (BZ 23)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',5-Trichlorobiphenyl (BZ 26)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',5'-Trichlorobiphenyl (BZ 34)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,5-Trimethylnaphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
2,3',6-Trichlorobiphenyl (BZ 27)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,7,8-TCDF	EPA 1613	Extractable Organics	NELAP	9/24/2001
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 1613	Extractable Organics	NELAP	9/24/2001
2,3-Dichlorobiphenyl (BZ 5)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3'-Dichlorobiphenyl (BZ 6)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,4',5-Tetrachlorobiphenyl (BZ 74)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,4',6-Tetrachlorobiphenyl (BZ 75)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,4'-Trichlorobiphenyl (BZ 28)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,5-Trichlorobiphenyl (BZ 29)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,6-Trichlorobiphenyl (BZ 30)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
2,4'-DDD	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
2,4'-DDE	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
2,4'-DDT	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
2,4'-Dichlorobiphenyl (BZ 8)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4-Dinitrotoluene (2,4-DNT)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
2,5-Dichlorobiphenyl (BZ 9)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,6-Dichlorobiphenyl (BZ 10)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,6-Dimethylnaphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
2,6-Dinitrotoluene (2,6-DNT)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
2-Amino-4,6-dinitrotoluene (2-am-dnt)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
2-Chlorobiphenyl (BZ 1)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

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E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Methylnaphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
2-Nitrotoluene	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4,5-Tetrachlorobiphenyl (BZ 78)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4-Trichlorobiphenyl (BZ 35)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',5-Trichlorobiphenyl (BZ 36)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3'-Dichlorobiphenyl (BZ 11)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4,4'-Trichlorobiphenyl (BZ 37)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4,5-Trichlorobiphenyl (BZ 38)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4',5-Trichlorobiphenyl (BZ 39)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4'-Dichlorobiphenyl (BZ 13)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,5-Dichlorobiphenyl (BZ 14)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3-Chlorobiphenyl (BZ 2)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3-Nitrotoluene	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
4,4'-DDD	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDE	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDT	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-Dichlorobiphenyl (BZ 15)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
4-Amino-2,6-dinitrotoluene (4-am-dnt)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
4-Chlorobiphenyl (BZ 3)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
4-Nitrotoluene	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
Acenaphthene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Acenaphthylene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Acetophenone	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Aldrin	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Alkalinity as CaCO3	EPA 310.1	General Chemistry	NELAP	9/24/2001
Alkalinity as CaCO3	SM 2320 B	General Chemistry	NELAP	9/24/2001
alpha-BHC (alpha-Hexachlorocyclohexane)	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
alpha-Chlordane	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aluminum	EPA 6010	Metals	NELAP	7/1/2003
Amenable cyanide	SM 4500-CN G	General Chemistry	NELAP	9/24/2001
Ammonia as N	EPA 350.1	General Chemistry	NELAP	9/24/2001

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E87570
STL Sacramento
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Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Anthracene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(a)anthracene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(a)pyrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(b)fluoranthene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(e)pyrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(g,h,i)perylene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(k)fluoranthene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzothiazole	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
beta-BHC (beta-Hexachlorocyclohexane)	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Biphenyl	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Bismuth	SAC-MT-0001	Metals	NELAP	7/1/2003
Boron	EPA 6010	Metals	NELAP	7/1/2003
Boron	SAC-MT-0001	Metals	NELAP	7/1/2003
Calcium	EPA 6010	Metals	NELAP	7/1/2003
Cerium	SAC-MT-0001	Metals	NELAP	7/1/2003
Chemical oxygen demand	EPA 410.4	General Chemistry	NELAP	9/24/2001
Chloride	EPA 300.0	General Chemistry	NELAP	9/24/2001
Chloropicrin	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Chromium VI	SM3500Cr E	General Chemistry	NELAP	9/24/2001
Chrysene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
cis-Nonachlor	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Conductivity	EPA 120.1	General Chemistry	NELAP	9/24/2001
Cyanide	SM 4500CN-E	General Chemistry	NELAP	9/24/2001
Decachlorobiphenyl (BZ 209)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
delta-BHC	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Dibenz(a,h) anthracene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Dieldrin	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Diisopropyl methyl phosphonate	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Dimethyl disulfide	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Dimethyl methyl phosphonate	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Endosulfan I	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endosulfan II	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endosulfan sulfate	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin aldehyde	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin ketone	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001

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Ethylmethylphosphonic acid	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Fluoranthene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Fluorene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Fluoride	EPA 340.2	General Chemistry	NELAP	9/24/2001
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
gamma-Chlordane	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Hardness	EPA 130.2	General Chemistry	NELAP	9/24/2001
Heptachlor	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Heptachlor epoxide	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Hexachlorobenzene	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Indeno(1,2,3-cd)pyrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Iron	EPA 6010	Metals	NELAP	7/1/2003
Iron	SAC-MT-0001	Metals	NELAP	7/1/2003
Isopropylmethylphosphonic acid	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Kjeldahl nitrogen - total	EPA 351.2	General Chemistry	NELAP	9/24/2001
Lithium	EPA 6010	Metals	NELAP	7/1/2003
Lithium	SAC-MT-0001	Metals	NELAP	7/1/2003
Magnesium	EPA 6010	Metals	NELAP	7/1/2003
Magnesium	SAC-MT-0001	Metals	NELAP	7/1/2003
Manganese	EPA 6010	Metals	NELAP	7/1/2003
Methoxychlor	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Methylphosphonic acid	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Mirex	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Naphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Nitrate as N	EPA 300.0	General Chemistry	NELAP	9/24/2001
Nitrate as N	EPA 353.2	General Chemistry	NELAP	9/24/2001
Nitrate-nitrite	EPA 300.0	General Chemistry	NELAP	9/24/2001
Nitrate-nitrite	EPA 353.2	General Chemistry	NELAP	9/24/2001
Nitrite as N	EPA 300.0	General Chemistry	NELAP	9/24/2001
Nitrite as N	EPA 353.2	General Chemistry	NELAP	9/24/2001
Nitrobenzene	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
Nitrocellulose	SAC-WC-0050	General Chemistry	NELAP	9/24/2001
Nitroglycerin	SAC-LC-0009	Extractable Organics	NELAP	11/7/2003
Nitroguanidine	SAC-LC-0010	Extractable Organics	NELAP	11/7/2003
o-Chloroacetophenone	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001

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Oil & Grease	EPA 1664	General Chemistry	NELAP	9/24/2001
Orthophosphate as P	EPA 300.0	General Chemistry	NELAP	9/24/2001
Orthophosphate as P	EPA 365.3	General Chemistry	NELAP	9/24/2001
Oxychlordane	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
p-Chlorophenyl methyl sulfide	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
p-Chlorophenyl methyl sulfone	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
p-Chlorophenyl methyl sulfoxide	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
p-Dithiane	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Pentaerythritoltetranitrate	SAC-LC-0009	Extractable Organics	NELAP	11/7/2003
Perchlorate	SAC-LC-0012	General Chemistry	NELAP	11/7/2003
Perylene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
pH	EPA 150.1	General Chemistry	NELAP	9/24/2001
Phenanthrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Phosphorus, total	EPA 365.3	General Chemistry	NELAP	9/24/2001
Phosphorus, total	EPA 6010	Metals	NELAP	7/1/2003
Phosphorus, total	SAC-MT-0001	Metals	NELAP	7/1/2003
Potassium	SAC-MT-0001	Metals	NELAP	7/1/2003
p-Oxathiane	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Pyrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
Residue-filterable (TDS)	EPA 160.1	General Chemistry	NELAP	9/24/2001
Residue-filterable (TDS)	SM 2540 C	General Chemistry	NELAP	9/24/2001
Residue-nonfilterable (TSS)	EPA 160.2	General Chemistry	NELAP	9/24/2001
Residue-settleable	EPA 160.5	General Chemistry	NELAP	9/24/2001
Residue-total	EPA 160.3	General Chemistry	NELAP	9/24/2001
Residue-volatile	EPA 160.4	General Chemistry	NELAP	9/24/2001
Sodium	SAC-MT-0001	Metals	NELAP	7/1/2003
Strontium	SAC-MT-0001	Metals	NELAP	7/1/2003
Sulfate	EPA 300.0	General Chemistry	NELAP	9/24/2001
Sulfide	EPA 376.2	General Chemistry	NELAP	9/24/2001
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
Thiodiglycol	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Thulium	SAC-MT-0001	Metals	NELAP	7/1/2003
Tin	SAC-MT-0001	Metals	NELAP	7/1/2003
Titanium	SAC-MT-0001	Metals	NELAP	7/1/2003
Total organic carbon	EPA 415.1	General Chemistry	NELAP	9/24/2001

Laboratory Scope of Accreditation

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State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Non-Potable Water

Analyte	Method/Tech	Category	Certification Type	Effective Date
Total organic carbon	SM 5310C	General Chemistry	NELAP	9/24/2001
Total phenolics	EPA 420.4	General Chemistry	NELAP	9/24/2001
trans Nanochlor	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Turbidity	EPA 180.1	General Chemistry	NELAP	9/24/2001
Uranium	SAC-MT-0001	Metals	NELAP	7/1/2003
Zirconium	SAC-MT-0001	Metals	NELAP	7/1/2003

Laboratory Scope of Accreditation

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State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,1,1,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,1,1-Trichloroethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,1,2,2-Tetrachloroethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,1,2-Trichloroethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,1-Dichloroethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,1-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,1-Dichloropropene	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8-Hxcdd	EPA 8280	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8-Hxcdf	EPA 8280	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,6,7,8-Hxcdd	EPA 8280	Extractable Organics	NELAP	9/24/2001
1,2,3,6,7,8-Hxcdd	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,6,7,8-Hxcdf	EPA 8280	Extractable Organics	NELAP	9/24/2001
1,2,3,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8,9-Hxcdd	EPA 8280	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8,9-Hxcdd	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8,9-Hxcdf	EPA 8280	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8,9-Hxcdf	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8-Pecdd	EPA 8280	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8-Pecdd	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8-Pecdf	EPA 8280	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	9/24/2001
1,2,3-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,2,3-Trichloropropane	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,2,4,5-Tetrachlorobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,2,4-Trichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,2,4-Trichlorobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,2-Dibromo-3-chloropropane (DBCP)	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,2-Dibromoethane (EDB, Ethylene dibromide)	EPA 8260	Volatile Organics	NELAP	9/24/2001

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State Laboratory ID: **E87570** **EPA Lab Code:** **CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,2-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,2-Dichloroethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,2-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,2-Diphenylhydrazine	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8095	Extractable Organics	NELAP	11/7/2003
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,3,5-Trinitrobenzene (1,3,5-TNB)	EPA 8330	Extractable Organics	NELAP	9/24/2001
1,3,5-Trinitrobenzene (1,3,5-TNB)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
1,3-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,3-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,3-Dichloropropane	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,3-Dinitrobenzene (1,3-DNB)	EPA 8095	Extractable Organics	NELAP	11/7/2003
1,3-Dinitrobenzene (1,3-DNB)	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,3-Dinitrobenzene (1,3-DNB)	EPA 8330	Extractable Organics	NELAP	9/24/2001
1,3-Dinitrobenzene (1,3-DNB)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
1,4-Dichlorobenzene	EPA 8260	Volatile Organics	NELAP	9/24/2001
1,4-Dichlorobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,4-Dinitrobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,4-Naphthoquinone	EPA 8270	Extractable Organics	NELAP	9/24/2001
1,4-Phenylenediamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
1-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	9/24/2001
1-Methylnaphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
1-Methylphenanthrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
1-Naphthylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',5,6,6'-Nonachlorobiphenyl (BZ 207)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',5,6-Octachlorobiphenyl (BZ 195)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',6,6'-Octachlorobiphenyl (BZ 197)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,5',6,6'-Nonachlorobiphenyl (BZ 208)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ 198)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

Jeb Bush
Governor

FLORIDA DEPARTMENT OF HEALTH

John O. Agwunobi, M.D., M.B.A.
Secretary

Laboratory Scope of Accreditation

THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE

State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,5,5',6'-Octachlorobiphenyl (BZ 199)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,5'-Heptachlorobiphenyl (BZ 172)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5',6,6'-Octachlorobiphenyl (BZ 201)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,6-Heptachlorobiphenyl (BZ 173)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5,6'-Heptachlorobiphenyl (BZ 174)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5',6-Heptachlorobiphenyl (BZ 175)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5',6'-Heptachlorobiphenyl (BZ 177)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5-Hexachlorobiphenyl (BZ 129)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,5'-Hexachlorobiphenyl (BZ 130)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,6,6'-Heptachlorobiphenyl (BZ 176)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4,6-Hexachlorobiphenyl (BZ 131)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',4-Pentachlorobiphenyl (BZ 82)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,5',6,6'-Octachlorobiphenyl (BZ 202)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,5',6-Heptachlorobiphenyl (BZ 178)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,5'-Hexachlorobiphenyl (BZ 133)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,6,6'-Heptachlorobiphenyl (BZ 179)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,6-Hexachlorobiphenyl (BZ 134)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5,6'-Hexachlorobiphenyl (BZ 135)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',5-Pentachlorobiphenyl (BZ 83)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',6,6'-Hexachlorobiphenyl (BZ 136)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3',6-Pentachlorobiphenyl (BZ 84)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,3'-Tetrachlorobiphenyl (BZ 40)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5,5',6-Octachlorobiphenyl (BZ 203)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5,6,6'-Octachlorobiphenyl (BZ 204)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5,6-Heptachlorobiphenyl (BZ 181)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',6,6'-Heptachlorobiphenyl (BZ 184)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,5,5',6-Heptachlorobiphenyl (BZ 185)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,5',6-Heptachlorobiphenyl (BZ 187)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,5,5'-Hexachlorobiphenyl (BZ 141)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,5'-Hexachlorobiphenyl (BZ 146)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

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State Laboratory ID: **E87570** **EPA Lab Code:** **CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: **Solid and Chemical Materials**

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,4,5,6,6'-Heptachlorobiphenyl (BZ 186)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,6,6'-Heptachlorobiphenyl (BZ 188)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,6-Hexachlorobiphenyl (BZ 147)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5,6'-Hexachlorobiphenyl (BZ 148)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,6,6'-Hexachlorobiphenyl (BZ 145)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',6,6'-Hexachlorobiphenyl (BZ 150)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4,6-Pentachlorobiphenyl (BZ 88)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4',6-Pentachlorobiphenyl (BZ 91)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,4'-Tetrachlorobiphenyl (BZ 42)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5,5'-Pentachlorobiphenyl (BZ 92)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5,6,6'-Hexachlorobiphenyl (BZ 152)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5,6'-Pentachlorobiphenyl (BZ 94)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5',6-Pentachlorobiphenyl (BZ 95)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,6,6'-Pentachlorobiphenyl (BZ 96)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,6-Tetrachlorobiphenyl (BZ 45)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3,6'-Tetrachlorobiphenyl (BZ 46)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',3-Trichlorobiphenyl (BZ 16)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',5,6'-Hexachlorobiphenyl (BZ 154)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',6,6'-Hexachlorobiphenyl (BZ 155)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4',6-Pentachlorobiphenyl (BZ 100)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,4'-Tetrachlorobiphenyl (BZ 47)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4.5,6'-Pentachlorobiphenyl (BZ 102)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,5',6-Pentachlorobiphenyl (BZ 103)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,5'-Tetrachlorobiphenyl (BZ 49)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,6,6'-Pentachlorobiphenyl (BZ 104)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,6-Tetrachlorobiphenyl (BZ 50)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',4-Trichlorobiphenyl (BZ 17)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

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E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',5,5'-Tetrachlorobiphenyl (BZ 52)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',5,6'-Tetrachlorobiphenyl (BZ 53)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',5-Trichlorobiphenyl (BZ 18)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',6,6'-Tetrachlorobiphenyl (BZ 54)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2',6-Trichlorobiphenyl (BZ 19)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,2-Dichloropropane	EPA 8260	Volatile Organics	NELAP	9/24/2001
2,3,3',4,4',5,5',6-Octachlorobiphenyl (BZ 205)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5,6-Heptachlorobiphenyl (BZ 190)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5',6-Heptachlorobiphenyl (BZ 191)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4',6-Hexachlorobiphenyl (BZ 158)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4',5,5',6-Heptachlorobiphenyl (BZ 193)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,5,5'-Hexachlorobiphenyl (BZ 159)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4',5,5'-Hexachlorobiphenyl (BZ 162)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,5',6-Hexachlorobiphenyl (BZ 161)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4',5'-Pentachlorobiphenyl (BZ 122)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4,6-Pentachlorobiphenyl (BZ 109)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',4-Tetrachlorobiphenyl (BZ 55)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',5,6-Pentachlorobiphenyl (BZ 112)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',5',6-Pentachlorobiphenyl (BZ 113)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',5-Tetrachlorobiphenyl (BZ 57)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',5'-Tetrachlorobiphenyl (BZ 58)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,3',6-Tetrachlorobiphenyl (BZ 59)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,4',5,6-Hexachlorobiphenyl (BZ 166)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',5',6-Hexachlorobiphenyl (BZ 168)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2',3,4,4',5-Pentachlorobiphenyl	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',5'-Pentachlorobiphenyl (BZ 123)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,4',6-Pentachlorobiphenyl (BZ 115)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4',6-Pentachlorobiphenyl (BZ 119)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

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State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3,4,4'-Tetrachlorobiphenyl (BZ 60)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,4'-Tetrachlorobiphenyl (BZ 66)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,5,5'-Pentachlorobiphenyl (BZ 120)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4',5,5'-Pentachlorobiphenyl (BZ 124)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4',5-Tetrachlorobiphenyl (BZ 63)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,5-Tetrachlorobiphenyl (BZ 67)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4',5-Tetrachlorobiphenyl (BZ 70)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,6,7,8-Hxcdf	EPA 8280	Extractable Organics	NELAP	9/24/2001
2,3,4,6,7,8-Hxcdf	EPA 8290	Extractable Organics	NELAP	9/24/2001
2,3,4',6-Tetrachlorobiphenyl (BZ 64)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4,6-Tetrachlorobiphenyl (BZ 69)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4',6-Tetrachlorobiphenyl (BZ 71)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,4,6-Tetrachlorophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,3,4,7,8-Pecdf	EPA 8280	Extractable Organics	NELAP	9/24/2001
2,3,4,7,8-Pecdf	EPA 8290	Extractable Organics	NELAP	9/24/2001
2,3,4'-Trichlorobiphenyl (BZ 22)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4-Trichlorobiphenyl (BZ 25)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',4'-Trichlorobiphenyl (BZ 33)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',5,5'-Tetrachlorobiphenyl (BZ 72)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,5,6-Tetrachlorobiphenyl (BZ 65)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',5',6-Tetrachlorobiphenyl (BZ 73)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,5-Trichlorobiphenyl (BZ 23)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',5-Trichlorobiphenyl (BZ 26)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3',5'-Trichlorobiphenyl (BZ 34)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,5-Trimethylnaphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
2,3',6-Trichlorobiphenyl (BZ 27)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3,7,8-TCDF	EPA 8280	Extractable Organics	NELAP	9/24/2001
2,3,7,8-TCDF	EPA 8290	Extractable Organics	NELAP	9/24/2001
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 8280	Extractable Organics	NELAP	9/24/2001
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA 8290	Extractable Organics	NELAP	9/24/2001
2,3-Dichlorobiphenyl (BZ 5)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,3'-Dichlorobiphenyl (BZ 6)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,4',5-Tetrachlorobiphenyl (BZ 74)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,4',6-Tetrachlorobiphenyl (BZ 75)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,4'-Trichlorobiphenyl (BZ 28)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,5-Trichlorobiphenyl (BZ 29)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003

Laboratory Scope of Accreditation

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E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,4',5-Trichlorobiphenyl (BZ 31)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,5-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,4,6-Trichlorobiphenyl (BZ 30)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4,6-Trichlorophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,4,6-Trinitrophenylmethylnitramine	EPA 8095	Extractable Organics	NELAP	11/7/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8095	Extractable Organics	NELAP	11/7/2003
2,4,6-Trinitrotoluene (2,4,6-TNT)	EPA 8330	Extractable Organics	NELAP	9/24/2001
2,4,6-Trinitrotoluene (2,4,6-TNT)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
2,4'-DDD	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
2,4'-DDE	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
2,4'-DDT	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
2,4'-Dichlorobiphenyl (BZ 8)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,4-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,4-Dimethylphenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,4-Dinitrophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,4-Dinitrotoluene (2,4-DNT)	EPA 8095	Extractable Organics	NELAP	11/7/2003
2,4-Dinitrotoluene (2,4-DNT)	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,4-Dinitrotoluene (2,4-DNT)	EPA 8330	Extractable Organics	NELAP	9/24/2001
2,4-Dinitrotoluene (2,4-DNT)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
2,5-Dichlorobiphenyl (BZ 9)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,6-Dichlorobiphenyl (BZ 10)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2,6-Dichlorophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,6-Dimethylnaphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
2,6-Dinitrotoluene (2,6-DNT)	EPA 8095	Extractable Organics	NELAP	11/7/2003
2,6-Dinitrotoluene (2,6-DNT)	EPA 8270	Extractable Organics	NELAP	9/24/2001
2,6-Dinitrotoluene (2,6-DNT)	EPA 8330	Extractable Organics	NELAP	9/24/2001
2,6-Dinitrotoluene (2,6-DNT)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
2-Acetylaminofluorene	EPA 8270	Extractable Organics	NELAP	9/24/2001
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8095	Extractable Organics	NELAP	11/7/2003
2-Amino-4,6-dinitrotoluene (2-am-dnt)	EPA 8330	Extractable Organics	NELAP	9/24/2001
2-Amino-4,6-dinitrotoluene (2-am-dnt)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
2-Butanone (Methyl ethyl ketone, MEK)	EPA 8260	Volatile Organics	NELAP	9/24/2001
2-Chlorobiphenyl (BZ 1)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
2-Chloroethyl vinyl ether	EPA 8260	Volatile Organics	NELAP	9/24/2001
2-Chloronaphthalene	EPA 8270	Extractable Organics	NELAP	9/24/2001
2-Chlorophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001

Jeb Bush
Governor

John O. Agwunobi, M.D., M.B.A.
Secretary

Laboratory Scope of Accreditation

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E87570
STL Sacramento
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West Sacramento, CA 95605

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
2-Hexanone	EPA 8260	Volatile Organics	NELAP	9/24/2001
2-Methyl-4,6-dinitrophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
2-Methylnaphthalene	EPA 8270	Extractable Organics	NELAP	9/24/2001
2-Methylnaphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
2-Methylphenol (o-Cresol)	EPA 8270	Extractable Organics	NELAP	9/24/2001
2-Nitroaniline	EPA 8270	Extractable Organics	NELAP	9/24/2001
2-Nitrophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
2-Nitrotoluene	EPA 8095	Extractable Organics	NELAP	11/7/2003
2-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	9/24/2001
2-Nitrotoluene	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
2-Picoline (2-Methylpyridine)	EPA 8270	Extractable Organics	NELAP	9/24/2001
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4,5-Tetrachlorobiphenyl (BZ 78)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4,5'-Tetrachlorobiphenyl (BZ 79)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',4-Trichlorobiphenyl (BZ 35)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3',5-Trichlorobiphenyl (BZ 36)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,3'-Dichlorobenzidine	EPA 8270	Extractable Organics	NELAP	9/24/2001
3,3'-Dichlorobiphenyl (BZ 11)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4,4'-Trichlorobiphenyl (BZ 37)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4,5-Trichlorobiphenyl (BZ 38)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4',5-Trichlorobiphenyl (BZ 39)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,4'-Dichlorobiphenyl (BZ 13)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3,5-Dichlorobiphenyl (BZ 14)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3-Chlorobiphenyl (BZ 2)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
3-Methylcholanthrene	EPA 8270	Extractable Organics	NELAP	9/24/2001
3-Methylphenol (m-Cresol)	EPA 8270	Extractable Organics	NELAP	9/24/2001
3-Nitroaniline	EPA 8270	Extractable Organics	NELAP	9/24/2001
3-Nitrotoluene	EPA 8095	Extractable Organics	NELAP	11/7/2003
3-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	9/24/2001
3-Nitrotoluene	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
4,4'-DDD	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDD	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDE	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001

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Analyte	Method/Tech	Category	Certification Type	Effective Date
4,4'-DDE	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDT	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDT	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-Dichlorobiphenyl (BZ 15)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8095	Extractable Organics	NELAP	11/7/2003
4-Amino-2,6-dinitrotoluene (4-am-dnt)	EPA 8330	Extractable Organics	NELAP	9/24/2001
4-Amino-2,6-dinitrotoluene (4-am-dnt)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
4-Aminobiphenyl	EPA 8270	Extractable Organics	NELAP	9/24/2001
4-Bromophenyl phenyl ether	EPA 8270	Extractable Organics	NELAP	9/24/2001
4-Chloro-3-methylphenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
4-Chloroaniline	EPA 8270	Extractable Organics	NELAP	9/24/2001
4-Chlorobiphenyl (BZ 3)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
4-Chlorophenyl phenylether	EPA 8270	Extractable Organics	NELAP	9/24/2001
4-Dimethyl aminoazobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
4-Methyl-2-pentanone (MIBK)	EPA 8260	Volatile Organics	NELAP	9/24/2001
4-Methylphenol (p-Cresol)	EPA 8270	Extractable Organics	NELAP	9/24/2001
4-Nitroaniline	EPA 8270	Extractable Organics	NELAP	9/24/2001
4-Nitrophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
4-Nitrotoluene	EPA 8095	Extractable Organics	NELAP	11/7/2003
4-Nitrotoluene	EPA 8330	Extractable Organics	NELAP	9/24/2001
4-Nitrotoluene	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
5-Nitro-o-toluidine	EPA 8270	Extractable Organics	NELAP	9/24/2001
7,12-Dimethylbenz(a) anthracene	EPA 8270	Extractable Organics	NELAP	9/24/2001
a-a-Dimethylphenethylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
Acenaphthene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Acenaphthene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Acenaphthene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Acenaphthylene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Acenaphthylene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Acenaphthylene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Acetone	EPA 8260	Volatile Organics	NELAP	9/24/2001
Acetonitrile	EPA 8260	Volatile Organics	NELAP	9/24/2001
Acetophenone	EPA 8270	Extractable Organics	NELAP	9/24/2001
Acetophenone	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Acrolein (Propenal)	EPA 8260	Volatile Organics	NELAP	9/24/2001
Acrylonitrile	EPA 8260	Volatile Organics	NELAP	9/24/2001

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Aldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aldrin	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Allyl chloride (3-Chloropropene)	EPA 8260	Volatile Organics	NELAP	9/24/2001
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
alpha-BHC (alpha-Hexachlorocyclohexane)	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
alpha-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
alpha-Chlordane	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aluminum	EPA 6010	Metals	NELAP	6/10/2003
Aniline	EPA 8270	Extractable Organics	NELAP	9/24/2001
Anthracene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Anthracene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Anthracene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Antimony	EPA 6010	Metals	NELAP	9/24/2001
Antimony	EPA 6020	Metals	NELAP	9/24/2001
Aramite	EPA 8270	Extractable Organics	NELAP	9/24/2001
Aroclor-1016 (PCB-1016)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1221 (PCB-1221)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1232 (PCB-1232)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1242 (PCB-1242)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1248 (PCB-1248)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1254 (PCB-1254)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1260 (PCB-1260)	EPA 8082	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Arsenic	EPA 6010	Metals	NELAP	9/24/2001
Arsenic	EPA 6020	Metals	NELAP	9/24/2001
Barium	EPA 6010	Metals	NELAP	9/24/2001
Barium	EPA 6020	Metals	NELAP	9/24/2001
Benzene	EPA 8260	Volatile Organics	NELAP	9/24/2001
Benzidine	EPA 8270	Extractable Organics	NELAP	9/24/2001
Benzo(a)anthracene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Benzo(a)anthracene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Benzo(a)anthracene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(a)pyrene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Benzo(a)pyrene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Benzo(a)pyrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(b)fluoranthene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Benzo(b)fluoranthene	EPA 8310	Extractable Organics	NELAP	9/24/2001

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State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
Benzo(b)fluoranthene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(e)pyrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(g,h,i)perylene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Benzo(g,h,i)perylene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Benzo(g,h,i)perylene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzo(k)fluoranthene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Benzo(k)fluoranthene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Benzo(k)fluoranthene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Benzoic acid	EPA 8270	Extractable Organics	NELAP	9/24/2001
Benzothiazole	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Benzyl alcohol	EPA 8270	Extractable Organics	NELAP	9/24/2001
Beryllium	EPA 6010	Metals	NELAP	9/24/2001
Beryllium	EPA 6020	Metals	NELAP	9/24/2001
beta-BHC (beta-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
beta-BHC (beta-Hexachlorocyclohexane)	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
beta-Naphthylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
Biphenyl	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
bis(2-Chloroethoxy)methane	EPA 8270	Extractable Organics	NELAP	9/24/2001
bis(2-Chloroethyl) ether	EPA 8270	Extractable Organics	NELAP	9/24/2001
bis(2-Chloroisopropyl) ether	EPA 8270	Extractable Organics	NELAP	9/24/2001
bis(2-Ethylhexyl) phthalate (DEHP)	EPA 8270	Extractable Organics	NELAP	9/24/2001
Bismuth	SAC-MT-0001	Metals	NELAP	9/24/2001
Boron	EPA 6010	Metals	NELAP	6/10/2003
Boron	SAC-MT-0001	Metals	NELAP	9/24/2001
Bromochloromethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
Bromodichloromethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
Bromoform	EPA 8260	Volatile Organics	NELAP	9/24/2001
Butyl benzyl phthalate	EPA 8270	Extractable Organics	NELAP	9/24/2001
Cadmium	EPA 6010	Metals	NELAP	9/24/2001
Cadmium	EPA 6020	Metals	NELAP	9/24/2001
Calcium	EPA 6010	Metals	NELAP	6/10/2003
Carbazole	EPA 8270	Extractable Organics	NELAP	9/24/2001
Carbon disulfide	EPA 8260	Volatile Organics	NELAP	9/24/2001
Carbon tetrachloride	EPA 8260	Volatile Organics	NELAP	9/24/2001
Cerium	SAC-MT-0001	Metals	NELAP	9/24/2001
Chlordane (tech.)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Chlorobenzene	EPA 8260	Volatile Organics	NELAP	9/24/2001
Chlorobenzilate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Chloroethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
Chloroform	EPA 8260	Volatile Organics	NELAP	9/24/2001
Chloropicrin	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Chloroprene	EPA 8260	Volatile Organics	NELAP	9/24/2001
Chromium	EPA 6010	Metals	NELAP	9/24/2001
Chromium	EPA 6020	Metals	NELAP	9/24/2001
Chrysene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Chrysene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Chrysene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
cis-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	9/24/2001
cis-1,3-Dichloropropene	EPA 8260	Volatile Organics	NELAP	9/24/2001
cis-Nonachlor	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Cobalt	EPA 6010	Metals	NELAP	9/24/2001
Cobalt	EPA 6020	Metals	NELAP	9/24/2001
Copper	EPA 6010	Metals	NELAP	9/24/2001
Copper	EPA 6020	Metals	NELAP	9/24/2001
Decachlorobiphenyl (BZ 209)	EPA 1668	Pesticides-Herbicides-PCB's	NELAP	6/10/2003
delta-BHC	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
delta-BHC	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Diallate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Dibenz(a, j) acridine	EPA 8270	Extractable Organics	NELAP	9/24/2001
Dibenz(a,h) anthracene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Dibenz(a,h) anthracene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Dibenz(a,h) anthracene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Dibenzofuran	EPA 8270	Extractable Organics	NELAP	9/24/2001
Dibromochloromethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
Dibromofluoromethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
Dibromomethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
Dichlorodifluoromethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
Dieldrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Dieldrin	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Diesel range organics (DRO)	EPA 8015	Extractable Organics	NELAP	9/24/2001
Diethyl phthalate	EPA 8270	Extractable Organics	NELAP	9/24/2001
Diisopropyl methyl phosphonate	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Dimethoate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Dimethyl disulfide	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Dimethyl methyl phosphonate	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Dimethyl phthalate	EPA 8270	Extractable Organics	NELAP	9/24/2001
Di-n-butyl phthalate	EPA 8270	Extractable Organics	NELAP	9/24/2001
Di-n-octyl phthalate	EPA 8270	Extractable Organics	NELAP	9/24/2001
Diphenylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
Endosulfan I	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endosulfan I	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endosulfan II	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endosulfan II	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endosulfan sulfate	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endosulfan sulfate	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin aldehyde	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin aldehyde	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin ketone	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin ketone	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Ethyl methacrylate	EPA 8260	Volatile Organics	NELAP	9/24/2001
Ethyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	9/24/2001
Ethylbenzene	EPA 8021	Volatile Organics	NELAP	9/24/2001
Ethylbenzene	EPA 8260	Volatile Organics	NELAP	9/24/2001
Ethylmethylphosphonic acid	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Fluoranthene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Fluoranthene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Fluoranthene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Fluorene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Fluorene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Fluorene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Fluoride	EPA 9056	General Chemistry	NELAP	9/24/2001
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
gamma-Chlordane	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
gamma-Chlordane	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Gasoline range organics (GRO)	EPA 8015	Extractable Organics	NELAP	9/24/2001

Laboratory Scope of Accreditation

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Heptachlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Heptachlor	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Heptachlor epoxide	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Heptachlor epoxide	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Hexachlorobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Hexachlorobenzene	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Hexachlorobutadiene	EPA 8260	Volatile Organics	NELAP	9/24/2001
Hexachlorobutadiene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Hexachlorocyclopentadiene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Hexachloroethane	EPA 8270	Extractable Organics	NELAP	9/24/2001
Hexachloropropene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Indeno(1,2,3-cd)pyrene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Indeno(1,2,3-cd)pyrene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Indeno(1,2,3-cd)pyrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Iodomethane (Methyl iodide)	EPA 8260	Volatile Organics	NELAP	9/24/2001
Iron	EPA 6010	Metals	NELAP	6/10/2003
Iron	SAC-MT-0001	Metals	NELAP	9/24/2001
Isobutyl alcohol (2-Methyl-1-propanol)	EPA 8260	Volatile Organics	NELAP	9/24/2001
Isodrin	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Isodrin	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Isophorone	EPA 8270	Extractable Organics	NELAP	9/24/2001
Isopropylmethylphosphonic acid	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Isosafrole	EPA 8270	Extractable Organics	NELAP	9/24/2001
Lead	EPA 6010	Metals	NELAP	9/24/2001
Lead	EPA 6020	Metals	NELAP	9/24/2001
Lithium	EPA 6010	Metals	NELAP	6/10/2003
Lithium	SAC-MT-0001	Metals	NELAP	9/24/2001
Magnesium	EPA 6010	Metals	NELAP	6/10/2003
Magnesium	SAC-MT-0001	Metals	NELAP	9/24/2001
Manganese	EPA 6010	Metals	NELAP	6/10/2003
Mercury	EPA 7470	Metals	NELAP	9/24/2001
Mercury	EPA 7471	Metals	NELAP	9/24/2001
Methacrylonitrile	EPA 8260	Volatile Organics	NELAP	9/24/2001
Methoxychlor	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Methoxychlor	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Methyl bromide (Bromomethane)	EPA 8260	Volatile Organics	NELAP	9/24/2001

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Methyl chloride (Chloromethane)	EPA 8260	Volatile Organics	NELAP	9/24/2001
Methyl methacrylate	EPA 8260	Volatile Organics	NELAP	9/24/2001
Methyl methanesulfonate	EPA 8270	Extractable Organics	NELAP	9/24/2001
Methyl parathion (Parathion, methyl)	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Methyl tert-butyl ether (MTBE)	EPA 8021	Volatile Organics	NELAP	9/24/2001
Methyl tert-butyl ether (MTBE)	EPA 8260	Volatile Organics	NELAP	9/24/2001
Methylene chloride	EPA 8260	Volatile Organics	NELAP	9/24/2001
Methylphosphonic acid	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Mirex	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Molybdenum	EPA 6010	Metals	NELAP	9/24/2001
Molybdenum	EPA 6020	Metals	NELAP	9/24/2001
Naphthalene	EPA 8260	Volatile Organics	NELAP	9/24/2001
Naphthalene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Naphthalene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Naphthalene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Nickel	EPA 6010	Metals	NELAP	9/24/2001
Nickel	EPA 6020	Metals	NELAP	9/24/2001
Nitrobenzene	EPA 8095	Extractable Organics	NELAP	11/7/2003
Nitrobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Nitrobenzene	EPA 8330	Extractable Organics	NELAP	9/24/2001
Nitrobenzene	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
Nitrocellulose	SAC-WC-0050	General Chemistry	NELAP	9/24/2001
Nitroglycerin	SAC-LC-0009	Extractable Organics	NELAP	11/7/2003
Nitroguanidine	SAC-LC-0010	Extractable Organics	NELAP	11/7/2003
n-Nitrosodiethylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
n-Nitrosodimethylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
n-Nitroso-di-n-butylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
n-Nitrosodi-n-propylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
n-Nitrosodiphenylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
n-Nitrosomethylethylamine	EPA 8270	Extractable Organics	NELAP	9/24/2001
n-Nitrosomorpholine	EPA 8270	Extractable Organics	NELAP	9/24/2001
n-Nitrosopiperidine	EPA 8270	Extractable Organics	NELAP	9/24/2001
n-Nitrosopyrrolidine	EPA 8270	Extractable Organics	NELAP	9/24/2001
o-Chloroacetophenone	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8095	Extractable Organics	NELAP	11/7/2003
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	EPA 8330	Extractable Organics	NELAP	9/24/2001

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Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
o-Toluidine	EPA 8270	Extractable Organics	NELAP	9/24/2001
Oxychlordane	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Parathion, ethyl	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
p-Chlorophenyl methyl sulfide	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
p-Chlorophenyl methyl sulfone	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
p-Chlorophenyl methyl sulfoxide	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
p-Dioxane	EPA 8260	Volatile Organics	NELAP	9/24/2001
p-Dithiane	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Pentachlorobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Pentachloronitrobenzene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Pentachlorophenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
Pentaerythritoltetranitrate	SAC-LC-0009	Extractable Organics	NELAP	11/7/2003
Perchlorate	SAC-LC-0012	General Chemistry	NELAP	11/7/2003
Perylene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
pH	EPA 9045	General Chemistry	NELAP	9/24/2001
Phenacetin	EPA 8270	Extractable Organics	NELAP	9/24/2001
Phenanthrene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Phenanthrene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Phenanthrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Phenol	EPA 8270	Extractable Organics	NELAP	9/24/2001
Phorate	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Phosphorus, total	EPA 6010	Metals	NELAP	6/10/2003
Phosphorus, total	SAC-MT-0001	Metals	NELAP	9/24/2001
Potassium	EPA 6010	Metals	NELAP	6/10/2003
Potassium	SAC-MT-0001	Metals	NELAP	9/24/2001
p-Oxathiane	SAC-MS-0003	Extractable Organics	NELAP	11/7/2003
Pronamide (Kerb)	EPA 8270	Extractable Organics	NELAP	9/24/2001
Propionitrile (Ethyl cyanide)	EPA 8260	Volatile Organics	NELAP	9/24/2001
Pyrene	EPA 8270	Extractable Organics	NELAP	9/24/2001
Pyrene	EPA 8310	Extractable Organics	NELAP	9/24/2001
Pyrene	SAC-ID-0015	Extractable Organics	NELAP	9/24/2001
Pyridine	EPA 8270	Extractable Organics	NELAP	9/24/2001
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8095	Extractable Organics	NELAP	11/7/2003
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	EPA 8330	Extractable Organics	NELAP	9/24/2001
RDX (hexahydro-1,3,5-trinitro-1,3,5-triazine)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001

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Analyte	Method/Tech	Category	Certification Type	Effective Date
Safrole	EPA 8270	Extractable Organics	NELAP	9/24/2001
Selenium	EPA 6010	Metals	NELAP	9/24/2001
Selenium	EPA 6020	Metals	NELAP	9/24/2001
Silica as SiO2	EPA 6010	Metals	NELAP	6/10/2003
Silver	EPA 6010	Metals	NELAP	9/24/2001
Silver	EPA 6020	Metals	NELAP	9/24/2001
Sodium	EPA 6010	Metals	NELAP	9/24/2001
Sodium	SAC-MT-0001	Metals	NELAP	9/24/2001
Strontium	EPA 6010	Metals	NELAP	6/10/2003
Strontium	SAC-MT-0001	Metals	NELAP	9/24/2001
Sulfotepp	EPA 8270	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Tetrachloroethylene (Perchloroethylene)	EPA 8260	Volatile Organics	NELAP	9/24/2001
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	EPA 8330	Extractable Organics	NELAP	9/24/2001
Tetryl (methyl-2,4,6-trinitrophenylnitramine)	SAC-LC-0001	Extractable Organics	NELAP	9/24/2001
Thallium	EPA 6010	Metals	NELAP	9/24/2001
Thallium	EPA 6020	Metals	NELAP	9/24/2001
Thiodiglycol	SAC-LC-0004	Extractable Organics	NELAP	9/24/2001
Thulium	SAC-MT-0001	Metals	NELAP	9/24/2001
Tin	EPA 6010	Metals	NELAP	6/10/2003
Tin	SAC-MT-0001	Metals	NELAP	9/24/2001
Titanium	SAC-MT-0001	Metals	NELAP	9/24/2001
Toluene	EPA 8021	Volatile Organics	NELAP	9/24/2001
Toluene	EPA 8260	Volatile Organics	NELAP	9/24/2001
Total cyanide	EPA 9012	General Chemistry	NELAP	9/24/2001
Total Heptachlorodibenzofuran	EPA 8280	Extractable Organics	NELAP	9/24/2001
Total Heptachlorodibenzo-p-dioxin	EPA 8280	Extractable Organics	NELAP	9/24/2001
Total Hexachlorodibenzofuran	EPA 8280	Extractable Organics	NELAP	9/24/2001
Total Hexachlorodibenzo-p-dioxin	EPA 8280	Extractable Organics	NELAP	9/24/2001
Total Pentachlorodibenzofuran	EPA 8280	Extractable Organics	NELAP	9/24/2001
Total Pentachlorodibenzo-p-dioxin	EPA 8280	Extractable Organics	NELAP	9/24/2001
Total Tetrachlorodibenzofuran	EPA 8280	Extractable Organics	NELAP	9/24/2001
Total Tetrachlorodibenzo-p-dioxin	EPA 8280	Extractable Organics	NELAP	9/24/2001
Toxaphene (Chlorinated camphene)	EPA 8081	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Toxicity Characteristic Leaching Procedure	EPA 1311	General Chemistry	NELAP	9/24/2001
trans Nanochlor	SAC-ID-0014	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
trans-1,2-Dichloroethylene	EPA 8260	Volatile Organics	NELAP	9/24/2001

Laboratory Scope of Accreditation

THIS LISTING OF ACCREDITED ANALYTES SHOULD BE USED ONLY WHEN ASSOCIATED WITH A VALID CERTIFICATE

State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Solid and Chemical Materials

Analyte	Method/Tech	Category	Certification Type	Effective Date
trans-1,3-Dichloropropylene	EPA 8260	Volatile Organics	NELAP	9/24/2001
trans-1,4-Dichloro-2-butene	EPA 8260	Volatile Organics	NELAP	9/24/2001
Trichloroethene (Trichloroethylene)	EPA 8260	Volatile Organics	NELAP	9/24/2001
Trichlorofluoromethane	EPA 8260	Volatile Organics	NELAP	9/24/2001
Uranium	SAC-MT-0001	Metals	NELAP	9/24/2001
Vanadium	EPA 6010	Metals	NELAP	9/24/2001
Vanadium	EPA 6020	Metals	NELAP	9/24/2001
Vinyl acetate	EPA 8260	Volatile Organics	NELAP	9/24/2001
Vinyl chloride	EPA 8260	Volatile Organics	NELAP	9/24/2001
Xylene (total)	EPA 8021	Volatile Organics	NELAP	9/24/2001
Xylene (total)	EPA 8260	Volatile Organics	NELAP	9/24/2001
Zinc	EPA 6010	Metals	NELAP	9/24/2001
Zinc	EPA 6020	Metals	NELAP	9/24/2001
Zirconium	SAC-MT-0001	Metals	NELAP	9/24/2001

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E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (BZ 206)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,4',5,5'-Octachlorobiphenyl (BZ 194)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,4',5-Heptachlorobiphenyl (BZ 170)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,4',6-Heptachlorobiphenyl (BZ 171)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,4'-Hexachlorobiphenyl (BZ 128)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,5,5',6-Octachlorobiphenyl (BZ 198)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,3',4,5,6,6'-Octachlorobiphenyl (BZ 200)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5,5'-Heptachlorobiphenyl (BZ 180)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5',6-Heptachlorobiphenyl (BZ 183)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5-Hexachlorobiphenyl (BZ 137)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',5'-Hexachlorobiphenyl (BZ 138)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,4',6'-Hexachlorobiphenyl (BZ 140)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5,6'-Hexachlorobiphenyl (BZ 143)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4',5',6-Hexachlorobiphenyl (BZ 149)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4,5'-Pentachlorobiphenyl (BZ 87)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4',6-Pentachlorobiphenyl (BZ 91)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,4-Tetrachlorobiphenyl (BZ 41)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5,5',6-Hexachlorobiphenyl (BZ 151)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',3,5'-Tetrachlorobiphenyl (BZ 44)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,4',5,5'-Hexachlorobiphenyl (BZ 153)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,4',5-Pentachlorobiphenyl (BZ 99)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,4',6-Pentachlorobiphenyl (BZ 100)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,5,5'-Pentachlorobiphenyl (BZ 101)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,5,6'-Pentachlorobiphenyl (BZ 102)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',4,6'-Tetrachlorobiphenyl (BZ 51)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5,6'-Tetrachlorobiphenyl (BZ 53)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,2',5-Trichlorobiphenyl (BZ 18)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,3',4,4',5,5'-Heptachlorobiphenyl (BZ 189)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,3',4,4',5-Hexachlorobiphenyl (BZ 156)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,3',4,4',5'-Hexachlorobiphenyl (BZ 157)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,3',4,4'-Pentachlorobiphenyl (BZ 105)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,3',4',6-Pentachlorobiphenyl (BZ 110)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',4,4',5,5'-Hexachlorobiphenyl (BZ 167)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2',3,4,4',5-Pentachlorobiphenyl	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,4,4',5-Pentachlorobiphenyl (BZ 114)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',4,4',5-Pentachlorobiphenyl (BZ 118)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

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State Laboratory ID: E87570 **EPA Lab Code: CA00044** **(916) 373-5600**

E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Biological Tissue

Analyte	Method/Tech	Category	Certification Type	Effective Date
2,3',4',5,5'-Pentachlorobiphenyl (BZ 124)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',4',5-Tetrachlorobiphenyl (BZ 70)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',4,6-Tetrachlorobiphenyl (BZ 69)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',4'-Trichlorobiphenyl (BZ 33)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3',5',6-Tetrachlorobiphenyl (BZ 73)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,3,6-Trichlorobiphenyl (BZ 24)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4,4'-Trichlorobiphenyl (BZ 28)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4,5-Trichlorobiphenyl (BZ 29)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
2,4'-Dichlorobiphenyl (BZ 8)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
3,3',4,4',5,5'-Hexachlorobiphenyl (BZ 169)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
3,3',4,4',5-Pentachlorobiphenyl (BZ 126)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
3,3',4,4'-Tetrachlorobiphenyl (BZ 77)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
3,4,4',5-Tetrachlorobiphenyl (BZ 81)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
3,4'-Dichlorobiphenyl (BZ 13)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4,4'-Dichlorobiphenyl (BZ 15)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
4-Chlorobiphenyl (BZ 3)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003
Decachlorobiphenyl (BZ 209)	SAC-ID-0013	Pesticides-Herbicides-PCB's	NELAP	7/1/2003

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STL Sacramento
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West Sacramento, CA 95605

Matrix: Air and Emissions

Analyte	Method/Tech	Category	Certification Type	Effective Date
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-hpcdf)	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-hpcdd)	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-hpcdf)	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8-Hxcdd	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,4,7,8-Hxcdf	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,6,7,8-Hxcdd	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,6,7,8-Hxcdf	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8,9-Hxcdd	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8,9-Hxcdf	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8-Pecdd	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
1,2,3,7,8-Pecdf	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
2,3,4,6,7,8-Hxcdf	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
2,3,4,7,8-Pecdf	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
2,3,7,8-TCDF	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
2,3,7,8-Tetrachlorodibenzo-p-dioxin	EPA TO-9A	Extractable Organics	NELAP	9/24/2001
4,4'-DDE	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDE	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDE	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDT	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDT	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
4,4'-DDT	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Acenaphthene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Acenaphthene	IP-7	Extractable Organics	NELAP	9/24/2001
Acenaphthylene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Acenaphthylene	IP-7	Extractable Organics	NELAP	9/24/2001
Aldrin	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aldrin	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aldrin	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
alpha-BHC (alpha-Hexachlorocyclohexane)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
alpha-BHC (alpha-Hexachlorocyclohexane)	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Anthracene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Anthracene	IP-7	Extractable Organics	NELAP	9/24/2001
Aroclor-1016 (PCB-1016)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001

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STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Air and Emissions

Analyte	Method/Tech	Category	Certification Type	Effective Date
Aroclor-1016 (PCB-1016)	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1221 (PCB-1221)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1221 (PCB-1221)	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1232 (PCB-1232)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1232 (PCB-1232)	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1242 (PCB-1242)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1242 (PCB-1242)	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1248 (PCB-1248)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1248 (PCB-1248)	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1254 (PCB-1254)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1254 (PCB-1254)	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1260 (PCB-1260)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Aroclor-1260 (PCB-1260)	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Benzo(a)anthracene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Benzo(a)anthracene	IP-7	Extractable Organics	NELAP	9/24/2001
Benzo(a)pyrene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Benzo(a)pyrene	IP-7	Extractable Organics	NELAP	9/24/2001
Benzo(b)fluoranthene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Benzo(b)fluoranthene	IP-7	Extractable Organics	NELAP	9/24/2001
Benzo(e)pyrene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Benzo(e)pyrene	IP-7	Extractable Organics	NELAP	9/24/2001
Benzo(g,h,i)perylene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Benzo(g,h,i)perylene	IP-7	Extractable Organics	NELAP	9/24/2001
Benzo(k)fluoranthene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Benzo(k)fluoranthene	IP-7	Extractable Organics	NELAP	9/24/2001
Chlordane (tech.)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Chlordane (tech.)	EPA TO-4A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Chlordane (tech.)	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Chloride	EPA 9057	General Chemistry	NELAP	4/5/2004
Chrysene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Chrysene	IP-7	Extractable Organics	NELAP	9/24/2001
Dibenz(a,h) anthracene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Dibenz(a,h) anthracene	IP-7	Extractable Organics	NELAP	9/24/2001
Dieldrin	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Dieldrin	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Endrin	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001

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E87570
STL Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Matrix: Air and Emissions

Analyte	Method/Tech	Category	Certification Type	Effective Date
Endrin aldehyde	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Fluoranthene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Fluoranthene	IP-7	Extractable Organics	NELAP	9/24/2001
Fluorene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Fluorene	IP-7	Extractable Organics	NELAP	9/24/2001
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
gamma-BHC (Lindane, gamma-Hexachlorocyclohexane)	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Heptachlor	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Heptachlor	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Heptachlor epoxide	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Heptachlor epoxide	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Indeno(1,2,3-cd)pyrene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Indeno(1,2,3-cd)pyrene	IP-7	Extractable Organics	NELAP	9/24/2001
Methoxychlor	EPA TO-10A	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Methoxychlor	IP-8	Pesticides-Herbicides-PCB's	NELAP	9/24/2001
Naphthalene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Naphthalene	IP-7	Extractable Organics	NELAP	9/24/2001
Phenanthrene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Phenanthrene	IP-7	Extractable Organics	NELAP	9/24/2001
Pyrene	EPA TO-13A	Extractable Organics	NELAP	9/24/2001
Pyrene	IP-7	Extractable Organics	NELAP	9/24/2001

ATTACHMENT D

Soil Permit

Soil Permit

Permit Number: S-44703 Revised

UNITED STATES DEPARTMENT OF AGRICULTURE

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Issued To: STL, Chicago
(Michael J. Healy)
2417 Bond Street
University Park, Illinois 60466

TELEPHONE: (708) 534-5200

Under the authority of the Federal Plant Pest Act of May 23, 1957, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a Compliance Agreement (PPQ Form 519) has been completed and signed. Compliance Agreements and Soil Permits are non-transferable. If you hold a Soil Permit and you leave your present employer or Company, you must notify your local USDA office promptly. A copy of this permit must accompany all shipments.
2. To be shipped in sturdy, leakproof, containers.
3. To be released without treatment at the port of entry to permittee or authorized user.
4. To be used only for analysis and only in the facility of the permittee at STL, Chicago, located in University Park, Illinois.
5. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
6. All unconsumed soil, containers, and effluent is to be autoclaved, incinerated, or heat treated by the permittee at the conclusion of the project as approved and prescribed by PPQ.
7. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands through any U.S. port of entry.

MARCH 31, 2010
Expiration Date

Lia Stewart
Approving Official LIA STEWART

WARNING: Any alteration, forgery, or unauthorized use of this Federal form is subject to civil penalties of up to $250,000 (7 U.S.C. s 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C. s 1001).

PPQ FORM 525B (8/94)

PART 1 - PERMITTEE

Soil Permit

Permit Number: S-46613

UNITED STATES DEPARTMENT OF AGRICULTURE

Animal and Plant Health Inspection Service

Plant Protection and Quarantine

Issued To: STL Sacramento
(Eric Redman)
880 Riverside Parkway
West Sacramento, California 95605

TELEPHONE: (916) 373-5600

Under the authority of the Federal Plant Pest Act of May 23, 1957, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a compliance agreement (PPQ Form 519) has been completed and signed. Compliance Agreements and Soil permits are non-transferable. If you hold a Soil Permit and you leave your present employer or company, you must notify your local USDA office promptly.
2. To be shipped in sturdy, leakproof, containers and released without treatment at the port of entry.
3. To be used only for analysis and only in the facility of the permittee at STL Sacramento, located in West Sacramento, California.
4. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
5. All unconsumed soil, containers, and effluent is to be autoclaved, incinerated, or heat treated by the permittee at the conclusion of the project as approved and prescribed by Plant Protection and Quarantine.
6. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands through any U.S. port of entry.
7. Permittee shall notify the office at the Yolo County Agricultural Commissioner upon arrival of shipment(s) at Area Cod (530) 666-8140.

JUNE 30, 2005
Expiration Date

Deborah M. Knott
Approving Official DEBORAH M. KNOTT

PPQ FORM 525B (8/94)

Pt. 1 - PERMITTEE

UNITED STATES DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE PROGRAMS

COMPLIANCE AGREEMENT

1. NAME AND MAILING ADDRESS OF PERSON OR FIRM	2. LOCATION
STL 880 Riverside Parkway West Sacramento, CA95661	same

3. REGULATED ARTICLE(S)
SOIL SAMPLES - from foreign sources or regulated areas within the United States.

4. APPLICABLE FEDERAL QUARANTINE(S) OR REGULATIONS
7CFR330.300 and 7CFR330.302 are regulations which restrict the movement of soil into or through the United States as well as from state to state. The State of California also restricts the movement of soil from other states into California.

6. *I/We agree to the following:*

Attached Stipulation, Attachment I - Stipulations for Handling Soil Samples.

Compliance Agreements and Departmental (Soil) permits are non-transferable. If you hold a Departmental (Soil) Permit and you leave your present employer or company, you must notify your local USDA office promptly. If permit material is to be used by other persons within the same company, those persons must be under the permittee's supervision or they must apply for their own permit. Notification to this office may help facilitate such circumstances.

7. SIGNATURE	8. TITLE	9. DATE SIGNED
[signature]	Laboratory Manager	3/1/2000

The affixing of the signatures below will validate this agreement which shall remain in effect until cancelled, but may be revised as necessary or revoked for noncompliance.

10. AGREEMENT NO.

11. DATE OF AGREEMENT

12. PPQ OFFICIAL (Name and Title)	13. ADDRESS
Carolyn O. Pizzo PPQ Officer	9550 Micron Avenue, Suite F Sacramento, CA 95827
14. SIGNATURE Carolyn O. Pizzo	
15. STATE AGENCY OFFICIAL (Name and Title)	16. ADDRESS Yolo County Dept. of Agriculture 70 Cottonwood St. Woodland, CA 95695
17. SIGNATURE	

PPQ FORM 519
AUG. 1977

REPLACES PPQ 274, 519, 540, AND AQI 83, WHICH ARE OBSOLETE

ATTACHMENT E

Chain of Custody

and

Job Sample Receipt Checklist Report

SEVERN TRENT **STL**

STL Chicago
2417 Bond Street
University Park, IL 60466
Phone: 708-534-5200
Fax: 708-534-5211

Report To:

Contact: ______
Company: ______
Address: ______
______
Phone: ______
Fax: ______
E-Mail: ______

Bill To:

Contact: ______
Company: ______
Address: ______
______
Phone: ______
Fax: ______
PO#: ______ Quote: ______

Shaded Areas For Internal Use Only ____ **of** ____

Lab Lot#

Package Sealed Yes No	**Samples Sealed** Yes No
Received on Ice Yes No	**Samples Intact** Yes No
Temperature °C of Cooler	
Within Hold Time Yes No	**Preserv. Indicated** Yes No NA
pH Check OK Yes No NA	**Res Cl_2 Check OK** Yes No NA
Sample Labels and COC Agree Yes No	**COC not present**

Sampler Name:	**Signature:**
Project Name:	**Project Number:**
Project Location:	**Date Required** Hard Copy: ___/___/___ Fax: ___/___/___
Lab PM:	

					Refrg #													
					# / Cont.													
					Volume													
					Preserv													
Laboratory ID	**MS-MSD**	**Client Sample ID**	**Sampling Date**	**Sampling Time**	**Matrix**	**Comp/Grab**												**Additional Analyses / Remarks**

RELINQUISHED BY	COMPANY	DATE	TIME	RECEIVED BY	COMPANY	DATE	TIME
RELINQUISHED BY	COMPANY	DATE	TIME	RECEIVED BY	COMPANY	DATE	TIME

Matrix Key

WW = Wastewater
W = Water
S = Soil
SL = Sludge
MS = Miscellaneous
OL = Oil
A = Air
SE = Sediment
SO= Solid
DS = Drum Solid
DL = Drum Liquid
L = Leachate
WI = Wipe
O = ______

Container Key

1. Plastic
2. VOA Vial
3. Sterile Plastic
4. Amber Glass
5. Widemouth Glass
6. Other ______

Preservative Key

1. HCl, Cool to 4°
2. H2SO4, Cool to 4°
3. HNO3, Cool to 4°
4. NaOH, Cool to 4°
5. NaOH/Zn, Cool to 4°
6. Cool to 4°
7. None

COMMENTS

Date Received ___/___/___
Courier: **Hand Delivered** ☐
Bill of Lading

rpjsckl — Job Sample Receipt Checklist Report — V2

Job Number.: 207213   Location.: 57222   Check List Number.: 1   Description.:
Customer Job ID.....:   Job Check List Date.: 12/14/2001   Date of the Report..: 04/14/2005
Project Number.: 20001703   Project Description.: USACE - Culebra Project   Project Manager.....: nsm
Customer.......:   Contact.:

Questions ?	(Y/N)	Comments
Chain-of-Custody Present?..........................	Y	
...If "yes", completed properly?..................	Y	
Custody seal on shipping container?...............	Y	
...If "yes", custody seal intact?.................	Y	
Custody seals on sample containers?...............	N	
...If "yes", custody seal intact?.................		
Samples iced?................................	Y	
Temperature of cooler acceptable? (4 deg C +/- 2).	Y	4.8,3.6
Samples received intact (good condition)?.........	Y	
Volatile samples acceptable? (no headspace).......		
Correct containers used?..........................	Y	
Adequate sample volume provided?..................	Y	
Samples preserved correctly?......................	Y	
Samples received within holding-time?.............	Y	
Agreement between COC and sample labels?..........	Y	
Radioactivity at or below background levels?......	Y	
A Sample Discrepancy Report (SDR) was needed?.....	N	
Comments..	N	
If samples were shipped was there an air bill #?..	Y	
Sample Custodian Signature/Date...................	Y	

ATTACHMENT F

Standard Operating Procedures

OPERATION-SPECIFIC STANDARD OPERATING PROCEDURE

TITLE: DETERMINATION OF PERCHLORATE BY ION CHROMATOGRAPHY BASED ON EPA METHOD 314.0

(SUPERSEDES: SAC-WC-0010, REVISION 1.0)

Prepared by: Kristina Hopper

Reviewed by: Technical Specialist, Barry Votaw

Approved by: Quality Assurance Manager, Pamela Schemmer

Approved by: Environmental Health and Safety Coordinator Joe Schairer

Approved by: Laboratory Director, Eric Redman

1. SCOPE AND APPLICATION

1.1. This procedure is based on EPA Method 314.0, Revision 1.0, November 1999, Dionex Application Note 134 and Dionex IonPac AS16 Anion-Exchange Column Literature.

1.2. This method covers the determination of perchlorate in drinking, ground, and surface waters using ion chromatography. Soils and wastes may also be analyzed using this procedure, following a DI Leach preparation according to SOP number SAC-WC-0049.

1.3. This method is only for use by or under the supervision of analysts experienced in the use of ion chromatography and in the interpretation of the resulting ion chromatograms.

1.4. This SOP specifies the use of a Dionex AG16, 4mm Guard column and an AS16, 4-mm Analytical column, and analytical conditions to meet method specifications. Equivalent columns or conditions may be used if method requirements are still met.

1.5. The reporting limit is 4.0 ug/L for aqueous samples and 40 ug/kg for solid samples. Lower reporting limits are achievable and may be implemented on a client or project specific basis.

2. SUMMARY OF METHOD

2.1. A 1.0 mL volume of sample is introduced into an ion chromatograph (IC). Perchlorate is separated and measured, using a system comprised of an ion chromatographic pump, sample injection valve, guard column, analytical column, suppressor device, and conductivity detector.

3. DEFINITIONS

3.1. Definitions of terms used in this SOP may be found in the glossary of the Laboratory Quality Manual (LQM).

4. INTERFERENCES

4.1. Method interferences may be caused by contaminants in the reagent water, reagents, glassware, and other sample processing apparatus that lead to discrete artifacts or elevated baselines in an ion chromatogram. These interferences can lead to false positive results for the target analyte as well as reduced detection limits as a consequence of elevated baseline noise.

4.2. Samples and reagent solutions that contain particulates larger than 0.45 microns require filtration to prevent damage to instrument columns and flow systems. Particulates can be separated by filtering the samples, standards, or reagents through a filter syringe with a 0.45-micron filter cartridge. All samples and standards pass through filter caps prior to injection. This filtering is sufficient when small amounts of particulate are present in a sample.

4.3. Sample matrices with high concentrations of common anions such as chloride, sulfate, and carbonate can destabilize the baseline in the perchlorate retention time window. This is evidenced by observing a protracted trailing following these anions, extending into the perchlorate window. These anions can be detected by conductivity testing, and dilutions should be performed accordingly.

4.4. A noisy baseline will also interfere with accurate recovery. Baseline noise is considered unacceptable if the peak to peak noise is greater than 0.015. If the instrument sits idle for more than a week or runs out of eluent or external water, the suppressor can become dry or overheated and will be unable to produce a clean baseline. Air bubbles trapped in the system, particularly the pump or conductivity cell, can also cause a noisy baseline.

4.4.1. For contaminated NaOH, remake the 32.7mM with a different source of 50% (w/w).

4.4.2. See the instrument manual for specific instructions on priming the pump, regenerating the suppressor, and flushing the conductivity cell.

4.5. Over time, some matrices will effect suppressor performance. This is evidenced by reduced peak response or asymmetrical perchlorate peaks, and should be corrected by cleaning the suppressor membranes according to manufacturer's instructions.

5. SAFETY

5.1. Procedures shall be carried out in a manner that protects the health and safety of all STL Sacramento associates.

5.2. Eye protection that satisfies ANSI Z87.1 (as per the Corporate Safety Manual), a laboratory coat, and appropriate chemically resistant gloves must be worn while samples, standards, solvents, and reagents are being handled. Disposable gloves that have been contaminated will be removed and discarded as hazardous waste; other gloves will be cleaned immediately.

5.3. The health and safety hazards of many of the chemicals used in this procedure have not been fully defined. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Additional health and safety information can be obtained from the Material Safety Data Sheets (MSDS) maintained in the laboratory. The following specific hazards are known:

5.3.1. The following materials are known to be **corrosive:** Sodium hydroxide.

5.3.2. The following materials are known to be oxidizers: Sodium perchlorate (powder).

5.4. All work must be stopped in the event of a known or potential compromise to the health and safety of a STL Sacramento associate. The situation must be reported **immediately** to a laboratory supervisor.

5.5. Exposure to chemicals must be maintained **as low as reasonably achievable**; therefore, all samples must be opened, transferred, and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

5.6. The preparation of standards and reagents will be conducted in a fume hood with the sash closed as far as the operation will permit.

5.7. Exercise caution when using syringes with attached filter assemblies. Application of excessive force has on occasion caused a filter disc to burst.

6. EQUIPMENT AND SUPPLIES

6.1. Ion Chromatograph (IC) – This method uses IC instrumentation manufactured by Dionex, Model DX500. Equipped with an autosampler, injection valve, pump with 1.5 mL/min flow rate, integrator, 1 mL sample loop, data acquisition system, and set up with the following components:

6.1.1. Columns: Dionex AG16, 4 mm (P/N 055377) and Dionex AS16, 4 mm (P/N 055376).

6.1.2. Suppressor: Dionex ASRS ULTRA (P/N 53946), external water mode, 300 mA current.

6.1.3. Detector: Dionex suppressed conductivity detector, Dionex CD20, cell temperature setting at 30 °C

6.2. Balance – Analytical balance, capable of accurately weighing to the nearest 0.0001 g.

6.3. Syringe, disposable, 2-10 mL capacity and equipped with male pressure fitting.

6.4. 0.45 micron acrodisk filters.

6.5. Dionex IC sample vials and filter caps –at least 5 mL capacity (P/N 38141).

6.6. Various class A analytical glassware of different sizes – graduated cylinder, volumetric flask, pipettes, etc.

6.7. Plastic bottles – 2-4L bottles are ideal for water and eluent reservoirs.

6.8. Conductivity meter

Note: It is permissible to change columns types, injection volumes, and/or eluents to improve separation or to lower costs, provided that the initial demonstration of capability is repeated and that the specifications as detailed in the reference method 314.0 are met.

7. REAGENTS AND STANDARDS

7.1. Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents shall conform to the specifications of the Committee on the Analytical Reagents of the American Chemical Society, where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

7.2. Reagent water: Distilled or deionized water, free of anions of interest. Water should contain particles no larger than 0.20 micron and have a resistance of at least 18 mega-ohms. For best results, use reagent water that is taken directly from the Nanopure water system.

7.3. Eluent solution:

7.3.1. 50% (w/w) NaOH, stock solution: Must be of highest purity (with low carbonate content). Commercially available, preferably in a 500 mL volume.

7.3.2. Eluent working solution: 32.7mM NaOH. Good for 5 days. A 2-liter volume will usually last for approximately 24 hours of non-stop use. A system that automatically generates eluent is an acceptable alternative.

NOTE: Avoid the introduction of carbon dioxide from the air into the 50% (w/w) NaOH. DO NOT shake the 50% (w/w) NaOH bottle or pipette the required aliquot from the top of the solution where sodium carbonate may have formed. IT IS BEST to pipette the aliquot from the middle of the bottle and to minimize the time the solution is exposed to air.

7.3.2.1. Fill a 2000-mL volumetric flask to the mark with Nanopure water. Pipette out 5.23 mL of the reagent water.

7.3.2.2. Transfer the remaining water from the flask to an eluent bottle.

7.3.2.3. De-gas the reagent water with He for at least 10 minutes.

7.3.2.4. Using a glass disposable 5-mL pipette, insert the pipette into the middle of the 50% (w/w) NaOH stock solution and pipette 5.23 mL, making sure that there is minimal solution adhering to the outside of the pipette.

7.3.2.5. Immediately transfer the solution to the reagent bottle. Cover and seal the bottle with parafilm. Gently invert the reagent bottle at least 10 times to properly mix the solution.

7.3.2.6. Remove the parafilm and connect the bottle to the instrument.

7.3.2.7. Dispose of expired eluent waste to the basic waste collection carboy.

7.4. Perchlorate stock solution, 1000 mg/L (or 1,000,000 ug/L): Obtain commercially. Alternatively, use a 1000-mL volumetric flask filled with approximately 600 mL of reagent water. Dissolve 1.2314 grams of sodium perchlorate (99% purity). (Note: sodium perchlorate represents a molar weight fraction of 81.2% perchlorate anion). Dilute to the mark with reagent water. Good for one year.

7.4.1. Intermediate standard solution, 10 mg/L (or 10,000 ug/L): Using a 100 mL volumetric flask containing at least 50 mL of reagent water, pipette 1 mL of the 1000 mg/L stock solution and swirl gently. Dilute to the mark with reagent water. Good for one month.

7.4.2. Working standards: Linear range 2 ug/L to 100 ug/L, good for one month. Dilute the intermediate standard (10,000 ug/L) with reagent water into 200 mL volumetric flasks as follows:

Standard #	Aliquot (mL)	Final Volume (mL)	Final concentration (ug/L)
1	0.04	200	2.00
2	0.08	200	4.00-ICCS
3	0.2	200	10.0
4	0.5	200	25.0
5	1.0	200	50.0-CCV
6	2.0	200	100-CCV

7.5. Second-Source Stock Standard, 100 mg/L (or 100,000ug/L): Obtain commercially. Alternatively, the second-source standard can be prepared from a different lot or different manufacturer other than the source of the Calibration Stock Standard. Good for 1 year.

7.6. Second-Source Working Standard, 50ug/L: Dilute 0.05 mL of the second-source stock standard to 100-mL in a volumetric flask for a final concentration of 50 ug/L. Good for one month.

7.7. Mixed Anion Stock Solution: Dissolve the following salts in reagent water for a final volume of 100 mL: 4.0 grams NaCl, 3.7 grams Na_2SO_4, and 4.4 grams Na_2CO_3. Final concentration: 25,000 mg/L chloride, sulfate, and carbonate anions. Good for one year.

7.8. Maximum Conductivity Threshold Standard (MCT) or Initial Performance Check standard (IPC), 25 ug/L perchlorate and 200 ug/L mixed anion standard: Mix 0.25 mL of the 10,000 ug/L perchlorate stock solution with 4 mL mixed anion stock solution (25000 ug/L) to a final volume of 100 mL. Good for one month.

Note: The MCT level can be adjusted, provided that the procedure in reference method 314.0 is followed.

8. SAMPLE COLLECTION, PRESERVATION AND STORAGE

8.1. Samples should to be collected in pre-cleaned plastic or glass containers. Volume collected should be sufficient to ensure a representative sample, allow for replicate analysis (if required), and minimize waste disposal.

8.2. Samples are stored at room temperature, no preservative.

8.3. Samples should be analyzed within 28 days of collection.

9. QUALITY CONTROL

9.1. Initial Demonstration of Capability: All analysts must successfully complete 4 LCSs prior to the analysis of any samples. Calculate the average recovery and standard deviation of the recovery. If the analyte does not meet the acceptance criteria, the test must be repeated. Repeated failure of the test indicates the need for the laboratory to evaluate the analytical procedure and take corrective action.

9.2. Method Detection Limit (MDL): The MDL is determined annually as described in SOP-QA-0006, MDLs and IDLs, and S-Q-003.

9.3. Maximum Conductivity Threshold (MCT): The highest permitted conductance of an unknown sample matrix, measured prior to conducting the analysis, which is used to determine when sample matrix dilution is required. The conductance in the MCT/sample is proportional to the concentration of common anions present. The MCT and the Instrument Performance Check (IPC) contain perchlorate, as well as the common anions of chloride, sulfate, and carbonate. These common anions are known to elute into the perchlorate window and cause potential interference. After the MCT is determined, it must be confirmed in each batch by the IPC. The IPC must meet three criteria:

9.3.1. Percent Difference of Area/Height ratio between the ICV and the IPC solution <25%.

9.3.2. 80%-120% Perchlorate Recovery.

9.3.3. Retention time shift <5% from ICV.

9.3.4. Corrective action: Restart batch. If IPC fails repeatedly, MCT must be re-established.

9.4. Batch: A quality control batch is a set of up to 20 field samples that have the same matrix and are processed using the same procedures, reagents, and standards within a 30 hour time period. A MB, LCS and MS/SD are also part of the batch. An analysis batch must also include all QC samples, however they do not contribute to the maximum of 20 samples.

Note: A field sample from the original batch can be reanalyzed after the closing CCV/CCB if it is still within 30 hours of the start of the run. An ICCS, as well as a CCV/CCB must be analyzed first, and the run must close with another CCV/CCB within that 30-hour window.

9.5. One Method Blank (MB) must be processed with every batch of similar matrix, not to exceed twenty (20) samples. The method blank is an aliquot of laboratory reagent water processed in the same manner and at the same time as the associated samples. Corrective actions must be documented on a Non-Conformance memo, then implemented when target analytes are detected in the method blank above the reporting limit. Re-extraction of the blank, other batch QC and the affected samples are required when the method blank is deemed unacceptable.

9.5.1. For aqueous analyses, the ICB is evaluated as the MB.

9.5.2. For solid analyses, a blank is prepared with the batch.

9.6. A Laboratory Control Sample (LCS) must be processed with every batch of similar matrix, not to exceed twenty (20) samples. The LCS is an aliquot of laboratory matrix (e.g. water, Ottawa sand, sodium sulfate, etc.) spiked with analytes of known identity and concentration. The LCS must be processed in the same manner and at the same time as the associated samples. Corrective actions must be documented in a Non-Conformance memo, then implemented when recoveries of any spiked analyte is outside control limits provided in LIMS or by the client. Reextraction of the blank, other batch QC and all associated samples are required if the LCS is deemed unacceptable. See Policy QA-003-SAC for specific acceptance criteria.

9.6.1. For aqueous analyses, the ICV is evaluated as the LCS.

9.6.2. Solid LCSs are spiked with a concentration of 500 ug/kg. A blank is prepared with the batch and spiked just prior to analysis.

9.6.3. LCS/DCS recoveries must be 90-110 % with an RPD of $\leq$ 15% for aqueous samples, and 75 – 125% with an RPD of < 20% for solid matrices.

9.7. A Matrix Spike/Matrix Spike Duplicate (MS/MSD or MS/SD) pair must be processed with every batch of similar matrix, not to exceed twenty (20) samples. An MS/MSD are aliquots of a selected field sample spiked with analytes of known identity and concentration. The MS/MSD pair must be processed in the same manner and at the same time as the associated samples. Spiked analytes with recoveries or precision outside control limits must be within control limits for the LCS. Corrective actions must be documented in a Non-Conformance memo, then implemented when recoveries of any spike analyte is outside control limits provided in LIMS or by the client. Re-extraction of the blank, LCS, the selected field sample and the MS/MSD may be required after evaluation and review.

9.7.1. Two aliquots of an aqueous sample are spiked with a concentration of 50 ug/L.

9.7.2. Solid samples are spiked with a concentration of 500 ug/kg. A sample duplicate is prepared with the batch and two aliquots are spiked just prior to analysis.

9.7.3. MS/SD recoveries must be 80 – 120% with RPD of <20 for aqueous, and 75 – 125% with RPD of <20% for solid matrices.

9.8. A duplicate control sample (LCSD or DCS) must be substituted when insufficient sample volume is provided to process an MS/MSD pair. The LCSD is evaluated in the same manner as the LCS. See Policy QA-003-SAC for specific acceptance criteria.

9.8.1. For aqueous samples, an additional ICV standard can be analyzed, or two 2 CCVs of identical concentration can be evaluated as the LCS/DCS.

9.9. The QC terms and criteria listed below are a combination of those specified by Method 314.0 and STL Sacramento standard QC requirements.

Acceptance Criteria and Corrective Actions-Perchlorate			
QC Type	***Frequency***	***Acceptance Criteria***	***Corrective Action***
Initial Calibration Curve	Calibrated initially, then monthly. Verified daily prior to analysis.	r > 0.995	Reanalyze once. If the problem persists, reprepare the standards, and recalibrate. If the problem persists, consult the supervisor for instrument repair.
ICV/REF/LCS-50ppb (Second Source Standard)	At start of every analytical sequence, following the initial calibration.	90%-110% Recovery	Reanalyze once. If the problem persists, reprepare the standards, reanalyze, and/or recalibrate.
ICB/CCB/MB	Directly following ICV/CCVs.	<1/2 Reporting Limit	Reanalyze once. If the problem persists, isolate the source of the problem and fix it. If the problem is isolated to the blank, reprepare, reanalyze and proceed. If the problem may have affected previous sample results (i.e. instrument failure, contaminated vials, etc.), reanalyze samples bracketed by the failed blank.
IPC/MCT-25ppb perchlorate, 600 ppm anions	1 per batch of 20 samples or fewer.	1. Percent Difference of Area/Height ratio between the ICV and the MCT solution <25% 2. 80%-120% Perchlorate Recovery 3. Retention time shift <5%	Restart analysis. If problem persists, MCT level may need to be reestablished.
ICCS-4ppb	At start of every analytical sequence, following the MCT.	75%-125% Recovery	Restart analysis. If baseline is noisy, attempt to reduce baseline noise. Recalibration may be necessary.
CCV-Alternate 50ppb/100ppb	After every 10 samples and at the end of the analytical sequence.	85%-115% Recovery	Reanalyze once. If the problem persists, isolate the source of the problem and fix it. If the problem is isolated to the standard (i.e. misspike, etc.), reprepare, reanalyze and proceed. If the problem may have affected previous sample results (i.e. instrument failure, contaminated vials, etc.), reanalyze samples bracketed by the failed standard.
MS/SD-50ppb aqueous	1 MS/MSD pair per batch of 20 samples or fewer.	80%-120% Recovery, 15%RPD	Reanalyze once. If reanalysis recovery fails but % RPD passes, accept data. If reanalysis passes, report reanalysis.
MS/SD-500ppb solid		75%-125% Recovery, 20%RPD	
MB-solid (ICB=MB for aqueous)	1 per batch of 20 samples or fewer	< Reporting limit	Reanalyze once. If problem persists, reprepare and reanalyze batch.
LCS - solid (ICV=LCS for aqueous)	1 per batch of 20 samples or fewer	75%-125%	Respike aliquot and reanalyze. If problem persists, reprepare and reanalyze batch.
Samples: (Conductivity of the sample must be measured and recorded prior to analysis).	Water-no preservative. Soil-10X 1 hour DI leach. 28 day hold time.	RLw=4ppb RLs=40ppb	Conductivity of the water aliquot must be less than the conductivity of the MCT/IPC. If higher, dilute prior to analysis.

10. CALIBRATION

10.1. Initial Instrument Calibration (ICAL): A minimum of five calibration standards that represent the linear range of the instrument are analyzed and used as the instrument calibration for a month. The initial calibration sequence is listed below:

Reagent Water
2 ppb Standard
4 ppb Standard
10 ppb Standard
25 ppb Standard
50 ppb Standard
100 ppb Standard

10.1.1. Frequency: Initially, then monthly, or as required due to failed ICV/CCV. Verify daily with an ICV.

10.1.2. Criteria: r value of 0.995 or better

10.1.3. Corrective Action for failed ICAL: Recalibrate. If ICAL fails again, check standards and remake as needed. For failed linear curve due to instrument failure, consult a Dionex service representative.

10.1.4. Retention time of samples and standards should be within 5% of that obtained during the initial calibration. If a shift of > 5% occurs, results can be used after filing an NCM, provided that the shift is confirmed by the daily QC. The instrument should be recalibrated prior to initiating a new analysis.

NOTE: A series of reagent water blanks are analyzed prior to the instrument calibration in order to verify that the instrument baseline is stable and peak to peak criteria is met. Peak to peak noise must be less than 0.015.

11. PROCEDURE

11.1. One time procedural variations are allowed only if deemed necessary in the professional judgment of the supervisor to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using a Nonconformance Memo and approved by a Technical Specialist and QA Manager. If contractually required, the client shall be notified. The Nonconformance Memo shall be filed in the project file.

11.2. Any unauthorized deviation from this procedure must also be documented as a nonconformance, with a cause and corrective action described. See SAC-QA-0023 for additional information on the established procedures for the identification and documentation of nonconformances and corrective actions.

11.3. Instrument Start-up

11.3.1. Use fresh reagent water from the Nanopure system to fill the External Water bottles (EBW1, EBW2 and EBW3).

11.3.2. Fill the Eluent bottle with 32.7mM NaOH.

11.3.3. Inspect all He connections.

11.3.4. Prime the pump. Refer to the instrument manual, if necessary.

11.3.5. Using the Peak Net workstation menu, access RUN mode. Under File, Load Method: newperchlorate.met. The current will change from 0 to 300 mA. The pump will start.

11.3.6. Ensure that water is flowing through the system. The water flow rate is determined by He pressure and can be adjusted by the analyst. Flow rate should be between 3-8 mL/minute, and can be measured by collecting water waste from the appropriate waste line for a specific period of time.

11.3.7. Let the instrument run until the baseline has stabilized. To monitor the baseline, under Run of the Run mode, select Baseline. In addition, observe the total baseline reading in uS at the CD20 screen.

11.3.7.1. To monitor peak to peak noise level, fill a sample vial with reagent water and run. Access the Optimize menu. Select the appropriate chromatogram. Select a 1 minute portion of the baseline. Under the Operations menu, select Autothreshold. Press Measure. The criteria for baseline reading must be met prior to sample analysis. If the baseline shows erratic response or severe noise (uS reading fluctuates frequently), see section 4.4, or consult the instrument manual.

11.3.8. As soon as the backpressure is stable around 2400 psi, baseline total uS is <2 uS and the pk to pk noise is <0.015, the instrument is ready for analysis.

11.4. Sample Pretreatment

11.4.1. Measure the conductivity of the sample using a calibrated conductivity meter and record the readings in the appropriate instrument logbook. If the conductivity of the sample is greater than the conductivity of the MCT/IPC, dilute the sample prior to analysis. Measure and record the conductivity of the diluted sample. The sample must be diluted to the point that the conductivity of the sample or diluted portion thereof is less than the conductivity of the MCT/IPC. The reporting limit associated with the diluted sample will increase in proportion to the dilution.

11.4.2. Filter colored or turbid samples prior to analysis.

11.4.3. Arrange standard and sample vials in the same order as below. Two water reagent water blanks are recommended prior to each analytical run to confirm a stable baseline.

ICV	@ 50 ppb (use as aqueous LCS)
ICB	
IPC (MCT)	@ 25 ppb, with 600 ppb mixed anions.
ICCS	@ 4 ppb
10 samples, including QC below	
LCS	@ 500 ppb (soils only)
MS	@ 50 ppb (waters), 500 ppb (soils)
MSD	@ 50 ppb (waters), 500 ppb (soils)
CCV	@ 100 ppb
CCB	
10 samples	
CCV	@ 50 ppb
CCB	

11.5. Sample Analysis

11.5.1. Build analysis schedule as noted above.

11.5.2. Access the Run Mode. Under the File menu, select Load schedule.

11.5.3. On the autosampler, make sure it is in “Run” mode.

11.5.4. Under the run menu, select Start.

11.5.5. Monitor run and noise level from time to time.

11.5.6. Monitor water and eluent levels while the run is in progress.

11.6. Instrument Shutdown

11.6.1. Access the Run Mode. Under File, load Method-pre-shutdown.met. This method shuts off the water. Next, load Method-shutdown.met. This will stop the pump and current.

-OR-

11.6.2. In the last two lines of the schedule, enter as the method pre-shutdown.met, followed by shutdown.met. This will automatically stop the water, eluent, and current flow at the close of the run.

11.7. Standard Conditions and Equipment

11.7.1. Ion Chromatograph: Dionex DX500

11.7.2. Sample Loop: 1 mL

11.7.3. Eluent: 32.7 mM NaOH

11.7.4. Eluent Flow: 1.5 mL/min

11.7.5. Columns: Dionex AG16, 4 mm / AS16, 4 mm

11.7.6. Suppressor: ASRS ULTRA, external water mode, 300 mA current

11.7.7. Detector: Suppressed Conductivity Detector, Dionex CD20

11.7.8. Pump: Dionex GP50

11.7.9. Peak to Peak Noise: <0.015

11.7.10. Background Conductivity: <2 uS

11.7.11. Typical System Backpressure: 2200 psi-2800 psi

11.7.12. Approximate Retention Time: 9.5 – 10.5 minutes

11.7.13. Allowable shift between calibrations-5%

11.7.14. Approximate Analysis Time-11.5 minutes

12. DATA ANALYSIS AND CALCULATIONS

12.1. Perchlorate Identification

12.1.1. Identification occurs when a peak matching the retention time of the reference standard is found at a concentration above the reporting limit, or above the MDL if J flags are required.

12.1.2. If the analyst is unsure of perchlorate in the sample due to matrix, retention time shifts, or other factors, the sample should be spiked, analyzed and evaluated. A split or shouldering peak is evidence of an interferant and should not be reported as perchlorate.

12.1.3. The experience of the analyst should weigh heavily in the interpretation of the chromatogram. For example, sample matrix or laboratory temperature fluctuation may result in a variance of retention times.

12.1.4. All manual or re-integration of chromatograms must be documented in accordance with Policy S-Q-004 and the STL Sacramento-specific addendum. Documentation includes, as a minimum, before and after copies of the chromatograms with a reference to the reason for re-integration.

12.2. Calibration Range

12.2.1. If the concentration of the perchlorate anion exceeds the working range as defined by the calibration standards, then the sample must be diluted and reanalyzed. The reporting limit must be raised accordingly.

12.2.2. Responses for the diluted sample must be at a minimum 3-5 times the level of the lowest standard.

12.2.3. It may be necessary to dilute samples due to matrix.

12.3. Calculations

12.3.1. Peak areas are used as a measure of response since they have been found to be more consistent than peak heights.

12.3.2. All sample concentrations are calculated based on a linear regression. The calculation is automatically performed by the instrument, based on the equation:

Equation 1 $$\text{Concentration} = A + BR$$

Where: A = Intercept

B = Slope

R = Response (in area)

Equation 2 Conc in Sample (ug/L) = Concentration (ug/L) x DF

Where: DF = Dilution Factor

Equation 3 Conc in Sample (ug/kg) = Concentration (ug/L) x (V_l/M_s) x DF

Where: DF = Dilution Factor

V_l = Volume of Leachate (in L)

M_s = Mass of soil (in kg)

12.4. Reporting Requirements

12.4.1. When it is necessary to redraw baselines, both the original and the redraw must be saved in the data system as well as included in the data pack.

12.4.2. Reporting limits and units are described in Section 1.5.

12.4.3. Sample results are entered into a LIMS system in accordance with current QA policies.

12.4.4. Footnotes and anomalies when applicable must be included in the data pack and data reduction process. Exceeded holding times must be immediately communicated to the project managers and followed by an electronically filed non-conformance memo.

13. METHOD PERFORMANCE

13.1. The group/team leader has the responsibility to ensure that this procedure is performed by an associate who has been properly trained in its use and has the required experience.

13.2. Both prep and analytical chemists must pass the initial demonstration of capability as outlined by this facility. Each laboratory must make a one time initial demonstration of capability for each individual method. Demonstration of capability for both soils and water matrices is required. This requires analysis of QC check samples containing all of the standard analytes for the method. For some tests it may be necessary to use more than one QC check mix to cover all analytes of interest.

13.3. The laboratory must generate a valid method detection limit for each analyte of interest. The MDL must be below the reporting limit for each analyte. The procedure for determination of the method detection limit is given in 40 CFR Part 136, Appendix B, and further defined in SAC-QA-006 and policy S-Q-003.

14. POLLUTION PREVENTION

14.1. When feasible, technological changes have been implemented to minimize the potential for pollution of the environment.

15. WASTE MANAGEMENT

15.1. Waste generated in the procedure will be segregated and disposed of into the waste streams detailed in the facility hazardous waste management plan.

15.2. Samples and other solutions containing high concentrations of toxic materials must be disposed of according to the facility hazardous waste management procedures.

16. REFERENCES

16.1. EPA Method 314.0, Determination of Perchlorate in Drinking Water using Ion Chromatography, Revision 1.0, November 1999.

16.2. Dionex Application Note 134.

16.3. Dionex IonPac AS16 Anion – Exchange Column Literature.

17. MISCELLANEOUS

17.1. Deviations from reference method.

17.1.1. Alternate matrices included.

17.1.2. According to Method 314.0, MDLs are to be performed over at least a 3-day period. Instead, STL's MDL Policy, S-Q-003 will be followed.

Although this policy allows for MDLs to be performed over multiple days, it does not require it. As a result, MDLs will generally be analyzed during one analysis on one day.

17.2. Summary of modifications to SOP from previous revisions.

17.2.1. The reporting limit was lowered to 4 ug/L for aqueous samples and 40 mg/kg for soil samples. The units were also corrected to read in ug instead of mg.

17.2.2. The MDL check standard was removed, as it was an extra step that was not required by the method or STL's MDL policy.

17.2.3. The sample duplicate was also removed. Per the method, it is necessary to run a sample duplicate, an LCSD, or an MSD per batch for precision monitoring. This requirement is met with the MSD.

17.2.4. Stock standards are to be obtained commercially rather than made from salts when possible.

17.2.5. The linear range was changed to 2 ug/L-100 ug/L.

17.2.6. Additional acceptance criteria for the IPC were added to reflect method requirements.

17.2.7. The level of the MCT was updated.

17.3. List of other SOPs cross-referenced in SOP.

17.3.1. SOP SAC-QA-0041 Calibration and Calibration Check of Balances.

17.3.2. Policy QA-008-SAC Data Recording Requirements.

17.3.3. Policy QA-003-SAC Quality Control Program

17.3.4. SOP SAC-WC-0009 Determination of Anions by Ion Chromatography

17.3.5. SOP SAC-WC-0049 Deionized Leaching Procedure for General Chemistry Analyses.

17.3.6. SAC-QA-0023, Nonconformance and Corrective Action System

17.3.7. SAC-QA-006, Method Detection Limits and Instrument Detection Limits

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Implementation Date: 11/22/02
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SOP No. SAC-WC-0049
Revision No. 2.0
Revision Date: 10/28/02

SEVERN TRENT SERVICES

STL SACRAMENTO STANDARD OPERATING PROCEDURE

TITLE: DEIONIZED WATER LEACHING PROCEDURE FOR GENERAL CHEMISTRY ANALYSES

(SUPERSEDES: SAC-WC-0049, REV. 1)

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1. SCOPE AND APPLICATION

1.1. This method is used for the preparation of samples for the analysis of water-soluble constituents by leaching with Deionized (D.I) water. Parameters that can be analyzed include chloride, sulfate, nitrate, nitrite, fluoride, alkalinity, specific conductivity, hexavalent chromium, perchlorate and other ions.

1.2. This method also covers soil extraction for ammonia analysis using 10% NaCl (acidified) instead of deionized water as the extraction buffer.

1.3. This method is applicable to soils, wastes, and other non-aqueous samples that are soluble in water.

1.4. The reporting limit depends on the analytical method used for the final determination. This prep method incorporates a 5X prep dilution. The prep factor can be adjusted based on the water absorbency of the sample. A 10X prep dilution is used for the determination of perchlorate.

1.5. The dynamic range depends on the analytical method used for final determination. The range may be extended by dilution of the leachate.

1.6. The analysis time depends on the analytical method used for final determination. The D.I. Leach prep takes approximately two hours per sample from initial weighing to final filtration. A number of samples can be prepared simultaneously following the standard batching protocols.

2. SUMMARY OF METHOD

2.1. A portion of a homogenized wet sample is leached with deionized water (DI Leach) for one hour, centrifuged, and filtered, depending on the nature of the sample. Aliquots of the leachate are preserved as appropriate for the parameters to be analyzed.

2.2. For ammonia, 10% NaCl (acidified to pH 2.5) is used for extraction instead of deionized water.

3. DEFINITIONS

3.1. Definitions of terms used in this SOP may be found in the glossary of the Laboratory Quality Manual (LQM).

4. INTERFERENCES

4.1. For alkalinity determination, leachates must be analyzed immediately after the leaching procedure is complete due to the possibility of calcium carbonate precipitation over time.

4.1.1. Errors may result from the following reactions: peptization, hydrolysis, ion exchange, mineral dissolution, absorption, and other phenomena.

4.1.2. Some samples such as dry drilling muds may soak up large volumes of water and prevent any liquid from being recovered. A smaller soil:water ratio must be used in these cases, such as 10X up to 100X prep factor.

5. SAFETY

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual, Sacramento Supplement to the CSM, and this document. All work must be stopped in the event of a known or potential compromise to the health or safety of an associate. The situation must be reported **immediately** to a supervisor, the EH&S Staff, or a senior manager.

5.1. Specific Safety Concerns or Requirements

5.1.1. Exercise caution when using syringes with attached filter assemblies. Application of excessive force has, upon occasion, caused a filter disc to burst during the process.

5.1.2. Eye protection that satisfies ANSI Z87.1, laboratory coat, and chemically resistant gloves must be worn while samples, standards, solvents, and reagents are being handled. Latex, PVC and nitrile gloves all provide adequate levels of protection against the chemicals used in this SOP.

5.1.3. Exposure to chemicals must be maintained **as low as reasonably achievable**, therefore all samples must be opened, transferred and prepared in a fume hood. Solvent and waste containers will be kept closed unless transfers are being made.

5.1.4. Laboratory procedures such as repetitive use of pipets, repetitive transferring of extracts, and manipulation of filled separatory funnels and other glassware represent a significant potential for repetitive motion or other ergonomic injuries. Laboratory associates performing these procedures are in the best position to realize when they are at risk for these types of injuries. Whenever a situation is found in which an employee is performing the same repetitive motion, the employee shall immediately bring this to the attention of their supervisor, manager, or the EH&S staff. The task will be analyzed to determine a better means of accomplishing it.

5.2. Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Sodium Hydroxide	Corrosive	2 Mg/M3-Ceiling	Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Contact with skin can cause irritation or severe burns and scarring with greater exposures. Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison Carcinogen	1 Mg/M3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6. EQUIPMENT AND SUPPLIES

6.1. Centrifuge tubes, 50 mL capacity.

6.2. Analytical balance, 0.1 g capability.

6.3. Mechanical shaker.

6.4. Centrifuge.

6.5. Filtration apparatus. Vacuum, pressure, or gravity filtration may be used depending on the nature of the samples.

6.6. 0.45 µm filters, 47 mm - or acrodisk filters with plastic syringe attachment.

7. REAGENTS AND STANDARDS

7.1. Sulfuric acid, 18N or 1:1 ratio: Add slowly, while stirring, concentrated sulfuric acid (reagent grade) to an equal volume of deionized water. Allow to cool before transferring to a bottle for storage.

WARNING: ALWAYS ADD ACID TO WATER, NEVER WATER TO ACID!

7.2. Sodium hydroxide, 10N: Dissolve 40 g of sodium hydroxide in deionized water and dilute to 100 mL. Allow to cool before transferring to a bottle for storage.

7.3. Sodium chloride, 10% (acidified): Dissolve 100 g of NaCl in 800 mL of deionized water. Acidify with concentrated HCl to pH of 2.5. Dilute to 1L.

7.4. Deionized water, reagent grade.

8. SAMPLE COLLECTION, PRESERVATION AND STORAGE

8.1. Samples are to be collected in suitable wide-mouth containers.

8.2. Samples are to be stored at $4^o \underline{+} 2^oC$.

8.3. Holding times have not been established for the soil samples for most methods. For most methods, holding time calculations begins after leaching. After the leaching is complete, the holding times for each parameter follows the holding time criteria for water samples for most tests. See the table below for specifics.

TABLE A – HOLD TIMES FOR LEACHATES

Analyte	Hold Time (from leaching to analysis, unless noted)	Preservation
Alkalinity	14 days (preferably 24 hours)	4+/- 2 degrees C
Specific Conductance	28 days (Note a)	4+/- 2 degrees C
Hexavalent Chromium	30 days to extract, 24 hours to analysis	4+/- 2 degrees C
Ammonia	28 days (Note a)	4+/- 2 degrees C (Note b)
NO2	48 hours	4+/- 2 degrees C
NO3	48 hours	4+/- 2 degrees C
OPO4	48 hours	4+/- 2 degrees C
Fluoride	28 days	4+/- 2 degrees C
Bromide	28 days	4+/- 2 degrees C
Chloride	28 days	4+/- 2 degrees C
Sulfate	28 days	4+/- 2 degrees C
NO2 + NO3 (unpreserved)	48 hours (Note a)	4+/- 2 degrees C
NO2 + NO3 (preserved)	28 days (Note a)	4+/- 2 degrees C (Note c)
Perchlorate	28 days (Note a)	None

Note a: Hold time is measured from date of sampling.

Note b: Verify pH is 2.5 or lower. If not, add 18N sulfuric acid to bring to 2.5 or lower.

Note c: Verify pH is 2 or lower. If not, add 18N sulfuric acid to bring to 2 or lower.

Note c: Verify pH is 2 or lower. If not, add 18N sulfuric acid to bring to 2 or lower.

9. QUALITY CONTROL

9.1. One method blank must be extracted with every process batch of similar matrix, not to exceed twenty (20) samples. The method blank is an aliquot of laboratory reagent water processed in the same manner and at the same time as the associated samples. Corrective actions must be documented on a Non-Conformance memo, and implemented when target analytes are detected in the method blank above the reporting limit. Re-extraction of the blank, other batch QC, and the affected samples are required when the method blank is deemed unacceptable. See Policy QA-003-SAC for specific acceptance criteria.

9.2. Duplicate blank leachate (for later use as an LCS): One duplicate blank must be extracted with every process batch of similar matrix, not to exceed twenty (20) samples. The duplicate blank is then spiked with analytes of known identity and concentration at the time of analysis. Corrective actions must be documented on a Non-Conformance memo, then implemented when recoveries of any spiked analyte is outside control limits provided on the LIMS or by the client.

9.3. Duplicate leachate (for later use as an MS/MSD): One duplicate sample must be leached, analyzed, and recorded with each batch of samples, not to exceed 20 samples. The duplicate leachate is then spiked with analytes of interest at time of analysis. If a duplicate analysis is requested, the relative percent difference (RPD) for the duplicate pair should be less than 20%. If the duplicate RPD is outside the control limit, impact on data will be assessed and narrated in the final report.

9.4. Acceptance criteria and corrective actions depend on the analytical methods used after sample prep.

10. PROCEDURE

10.1. One time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using a Nonconformance Memo and is approved by a Technical Specialist and QA Manager. If contractually required, the client shall be notified. The Nonconformance Memo shall be filed in the project file.

10.2. Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

10.3. Homogenize sample by thoroughly mixing the entire contents of the sample bottle with a spatula before taking a portion.

10.4. Weigh 10.0 g sample into a 50 mL centrifuge tube. Record the amount of sample used on the bench sheet. The centrifuge tube must be properly labeled with the sample ID, date of preparation, QC batch ID, initials of the prep analyst, and type of leachate. Perchlorate is prepared using 5.0 grams of sample. The soil to water ratio is 1:10.

Note: *Sample weight, DI water volume, and size of bottle may be reduced as long as soil to water ratio is 1:5 and the final volume of leachate is sufficient for the tests required.*

10.4.1. For Method Blanks, use Ottawa sand or similar matrix.

10.5. LCS Spike Levels

10.5.1. A blank is prepared in duplicate with each prep batch. At the analytical stage, one blank is analyzed as the method blank. The other is spike and analyzed as the LCS. See below for specific spike levels. Additionally, a sample is prepared in duplicate and spiked for MS/SD at the analytical stage.

10.5.2. For alkalinity and specific sonductance, the LCS is a whole volume standard that is not spiked, but poured directly into tubes for analysis. No leachate spiking is necessary.

10.5.3. For hexavalent chromium – Add 0.2 mL of 5 ppm Cr(VI) standard to 9.8 mL of blank solution prepped with the batch. The final concentration is 0.10 mg/L. Be sure to divide by the weight.

10.5.4. For ammonia – Add 0.1 mL of 100 ppm NH3 standard to .9 mL of blank solution prepped with the batch. The final concentration is 2.0 mg/L. Be sure to divide by the weight.

10.5.5. For general anions analyzed by ion chromatography (IC) Method 300.0 or 9056 – Add 0.5 mL of IC spiking solution to 4.5 mL of blank solution prepared with the batch. The final concentration is: 1 ppm for NO_2, NO_3; 2 ppm for OPO_4; 5 ppm for fluoride and bromide; 10 ppm for chloride and 10 ppm for sulfate. All have to be divided by the weight to calculate for spike level added in mg/kg units.

10.5.6. For nitrate, nitrite analyzed by automated colorimetry – Add 0.2 mL of 10 ppm NO3/NO2 standard to 4.8 mL of blank solution prepped with the batch. The final concentration is 0.40 mg/L. Remember to divide by the weight.

10.5.7. For perchlorate analyzed by ion chromatography method 314.0 – Add 25 uL of 10,000 ppb Perchlorate working standard to 5 mL of water from the blank prepared with the batch. The final concentration is 50 ppb. Remember to divide by the weight.

10.6. Add 50 g of deionized water.

Note: *For ammonia leachates, use 10% NaCl (acidified) in lieu of deionized water. Otherwise, prep factor and leaching procedure is the same.*

10.7. Cap each centrifuge securely.

10.8. Place the centrifuge tubes on the mechanical shaker. Agitate the samples at a rate of speed that maintains a constant state of agitated suspension. Leave on the shaker for one hour. Record start time on the bench sheets.

10.9. After one hour, remove the samples from the shaker. Record end time.

10.10. Separate the liquid phase by centrifuging the samples for 5 - 10 minutes, if needed. Apply filtration to the samples using a 0.45 µm filter, if needed. Treat the method blank in the same manner.

10.10.1. For hexavalent chromium only - if the sample is high in salts where it is extremely difficult to settle the particulates or filter them through the 0.45 µm filter, add 0.2 g of NaCl to the entire suspension. Shake for 1 minute, then centrifuge and finally filter prior to Cr^{+6} determination. Treat the method blank and duplicate leachate in the same manner. No preservation needed.

10.11. Preserve aliquots of the filtrate according to the analyses required. See Table A, Section 8.

11. DATA ANALYSIS AND CALCULATIONS

11.1. Divide the sample weight by the volume of water added to obtain the weight, normally a 0.2 weight is used:

$$W = \frac{\text{Mass of wet sample used (g)}}{\text{Final volume (mL) or mass (g) of water added to the wet sample}}$$

11.2. For final concentration of sample in mg/kg:

S, mg/kg = [Final concentration found in the leachate (mg/L)]/weight

11.3. Reporting limit (RLs), in mg/kg:

RLs, mg/kg = (RLw) / (W) x (DF)

Where:

RLw = normal reporting limit of water samples (mg/L)
W = weight (to convert mg/L to mg/kg)
DF = dilution factor used at the analysis stage

12. METHOD PERFORMANCE

12.1. The group/team leader has the responsibility to ensure that this procedure is performed by an associate who has been properly trained in its use and has the required expertise.

12.2. This procedure by itself does not have any results. However, when calculating the results from the analysis of the leachate, report results in mg/Kg.

13. POLLUTION PREVENTION

13.1. All waste will be disposed of in accordance with Federal, State and Local regulations.

13.2. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

13.3. Proportional reductions in sample and reagent volume are permitted in accordance with paragraph 10.4. This reduces the excess sample, waste and unused reagent that must be disposed of.

14. WASTE MANAGEMENT

The following waste streams are produced when this method is carried out.

14.1 Assorted test tubes, autovials, syringes, filter discs and extracted soil samples. Dump the solid waste into a contaminated lab trash bucket. When the bucket is full or at the end of the day, tie the plastic bag liner shut and put the lab trash into the steel collection drum in the H3 closet. When the drum is full or after no more than 75 days, move it to the waste collection area for shipment.

15. REFERENCES

15.1. This procedure was adapted from Section 10-2.3., "Methods of Soil Analysis, Part 2, Chemical and Microbiological Properties," Second Edition, Edited by A.L. Page.

15.2. Method 300.0, "Determination of Inorganic Anions by Ion Chromatography," Methods for the Determination of Inorganic Substances in Environmental Samples, USEPA, August 1993. Section 11.7.

15.3. SW-846, Third Edition, Chapter 3, December 1996.

15.4. For Ammonia preparation, Methods for Determination of Inorganic Substances in Water and Fluvial Sediments, USGS, Book 5, Chapter A1, 1979. Method 1-6523-78., Nitrogen, ammonia, total in bottom material, colorimetric, extraction-indophenol, automated, Section 6.1, page 420.

16. MISCELLANEOUS

16.1. Deviations from reference method.

16.1.1. The sample is not air-dried before prep. Results are adjusted based on dry weight if requested.

16.1.2. Sodium hexametaphosphate is not used as a preservative. The preservative appropriate to the particular analyte is employed.

16.1.3. A prep factor of 5X is used in lieu of a 10X prep factor as recommended in Method 300.0.

16.1.4. For ammonia, the final volume is not adjusted at the end of the filtration stage. Instead the total final volume is added at the beginning of the extraction.

16.2. Summary of modifications to SOP from previous revisions.

16.2.1. Format updated to reflect name change from Quanterra to STL Sacramento.

16.2.2. Added table – Sample collection, preservation and storage

16.2.3. Added perchlorate to list of parameters that can be prepared using DI leach.

16.2.4. The LCS is now spiked at the analytical stage.

16.3. Procedure flow diagram

START

Homogenize the samples

Weigh 10 g of sample into a 50 mL centrifuge tube

For Perchlorate weigh 5 g of sample

Record the weight on the bench sheet

Add 50 g of deionized water

Label the bottle with sample ID and put a cap on the bottle

Place the sample on a mechanical shaker for one hour

If needed, separate the liquid phase by centrifuging and filtration

Preserve the aliquots of the filtrate appropriately

Calculate and record the prep dilution factor

END

SOP Number:	SAC-WC-0049 Rev. 2 Change Form Number: 1
SOP Title:	DEIONIZED WATER LEACHING PROCEDURE FOR GENERAL CHEMISTRY ANALYSES
SOP Sections Affected by Change:	Table A, Sections 5, 14, and 15
Reason for Addition or Change:	Correct the holding time for hexavalent chromium, update to current EH&S Standard.
Change Effective From [Date]:	12/1/04
Change or Addition (Specific Section; use additional sheets if necessary.):	Table A, amend the hexavalent chromium holding time as follows: 30 days to extract, 24 hours to analysis Section 5, change to read: 5. SAFETY Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual, Sacramento Supplement to the CSM, and this document. All work must be stopped in the event of a known or potential compromise to the health or safety of an associate. The situation must be reported immediately to a supervisor, the EH&S Staff, or a senior manager. 5.1 Specific Safety Concerns or Requirements 5.1.1 Exercise caution when using syringes with attached filter assemblies. Application of excessive force has, upon occasion, caused a filter disc to burst during the process. 5.1.3 Eye protection that satisfies ANSI Z87.1, laboratory coat, and chemically resistant gloves must be worn while samples, standards, solvents, and reagents are being handled. Latex, PVC and nitrile gloves all provide adequate levels of protection against the chemicals used in this SOP. 5.1.4 Exposure to chemicals must be maintained as low as reasonably achievable, therefore all samples must be opened, transferred and prepared in a fume hood. Solvent and waste containers will be kept closed unless transfers are being made. 5.1.5 Laboratory procedures such as repetitive use of pipets, repetitive transferring of extracts, and manipulation of filled separatory funnels and other glassware represent a significant potential for repetitive motion or other ergonomic injuries. Laboratory associates performing these procedures are in the best position to realize when they are at risk for these types of injuries. Whenever a situation is found in which an employee is performing the same repetitive motion, the employee shall immediately bring this to the attention of their supervisor, manager, or the EH&S staff. The task will be analyzed to determine a better means of accomplishing it. 5.2 Primary Materials Used The following is a list of the materials used in this method, which have a serious or significant hazard rating. NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

SOP Number:	SAC-WC-0049 Rev. 2 Change Form Number: 1
	--Table of Materials -- Material (1) Hazards Exposure Limit (2) Signs and symptoms of exposure Sodium Hydroxide Corrosive 2 Mg/M3-Ceiling Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Contact with skin can cause irritation or severe burns and scarring with greater exposures. Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness. Sulfuric Acid CorrosiveOxidizerDehydratorPoisonCarcinogen 1 Mg/M3-TWA Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness. 1 – Always add acid to water to prevent violent reactions. 2 – Exposure limit refers to the OSHA regulatory exposure limit. -- End of Table -- Section 13, change to read: 13. Pollution Prevention 13.1 All waste will be disposed of in accordance with Federal, State and Local regulations. 13.2 Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for “Waste Management and Pollution Prevention.” 13.3 Proportional reductions in sample and reagent volume are permitted in accordance with paragraph 10.4. This reduces the excess sample, waste and unused reagent that must be disposed of. Section 14, change to read: 14. Waste Management The following waste streams are produced when this method is carried out. 14.1 Assorted test tubes, autovials, syringes, filter discs and extracted soil samples. Dump the solid waste into a contaminated lab trash bucket. When the bucket is full or at the end of the day, tie the plastic bag liner shut and put the lab trash into the steel collection drum in the H3 closet. When the drum is full or after no more than 75 days, move it to the waste collection area for shipment.

Submitted by: Lisa Stafford **Date:** 1/24/2005

Approved by: *

Technical Reviewer: *Date:* 1/25/05

EH&S Signature: *Date:* 1/25/05

QA Signature: Pamela Schemmer *Date:* 1/25/05

Management Signature: Karla Buechler Date 2/8/05

Must be same signature authorities of SOP being revised.

SOP No.	Revision No.	Date	Page
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TITLE: HIGH PERFORMANCE LIQUID CHROMATOGRAPHY Nitroaromatics and Nitramines by SW-846 8330/8332

Updated by:	Signature:	Date:
Sharon A. Newkirk HPLC Chemist	Sharon A Newkirk	4/4/05

Approved by:	Signature:	Date:
Patti J. Gibson Section Manager, Organics Dept.	Patti Gibson	4/5/05
David W. Mazur Env. Health & Safety Coor.	D W Mazur	4/6/05
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1.0 SCOPE / APPLICATION

This Standard Operating Procedure (SOP) outlines the trace analysis of explosive residues by High Performance Liquid Chromatography (HPLC) using a UV detector. This SOP was written using SW-846 Methods 8330, 8332, and 8000B as references and is used to determine the concentration of the following compounds in a water, soil, sediment matrix.

ID	Compound	CAS No.*
HMX	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	2691-41-0
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine	121-82-4
1,3,5-TNB	1,3,5-Trinitrobenzene	99-35-4
1,3-DNB	1,3-Dinitrobenzene	99-65-0
Tetryl	Methyl-2,4,6-trinitrophenylnitramine	479-45-8
NB	Nitrobenzene	98-95-3
2,4,6-TNT	2,4,6-Trinitrotoluene	118-96-7
2,6-DNT	2,6-Dinitrotoluene	606-20-2
2,4-DNT	2,4-Dinitrotoluene	121-14-2
2-Am-DNT	2-Amino-4,6-dinitrotoluene	355-72-78-2
4-AM-DNT	4-Amino-2,6-dinitrotoluene	1946-51-0
2-NT	2-Nitrotoluene	88-72-2
4-NT	4-Nitrotoluene	99-99-0
3-NT	3-Nitrotoluene	99-08-1
NG	Nitroglycerine **	55-63-0
PETN	Pentaerythritol tetranitrate **	78-11-5

* Chemical Abstracts Service Registry Number
** Extraction and analysis are the same for these compounds, with the exception of the wavelength used for this analysis (sec.4.2.2)

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP) and authorized via laboratory signature approval; and amended to the data packages case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

1.1.2 Reporting Limits

Reporting Limits (Attachment 1) are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. The laboratory maintains reporting limits that are higher than the MDL. Wherever possible, reporting is limited to values approximately 3-5x the respective MDL to ensure confidence in the value reported.

1.1.3 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM).

1.2 Summary of Method

This method provides instrument operating parameters for the detection of ppb levels of certain explosives in extracts of soil, sediment or water samples by HPLC.

All of the compounds listed above are either used in the manufacture of explosives or are the degradation products of compounds used for that purpose. For compounds other than these, or for other sample sources, the analyst must demonstrate the usefulness of the method by performing an MDL study, and collecting precision and accuracy data on actual samples.

1.2.1 Low-Level Water Method (Salting Out)

Aqueous samples of low concentration are prepared for analysis by a reverse salting-out extraction procedure with acetonitrile and sodium chloride.

1.2.2 High-Level Water Method (Option)

Direct injection of diluted and filtered water samples can be used for water samples of higher concentrations. (Reporting limits can be established).

1.2.3 Soil and Sediment Samples

Soil and sediment samples are extracted using acetonitrile in an ultrasonic bath.

1.2.4 Solid Phase Extraction (SPE)

Aqueous samples are prepared for analysis by passing sample through a solid-phase media and then eluted from media by using appropriate solvent.

2.0 INTERFERENCES

- Solvents, glassware and other sample processing hardware may yield discrete artifacts and/or elevated baselines, causing misinterpretation of the chromatograms. All of these materials must be demonstrated to be free from interference under the conditions of the analysis by running method blanks.
- All glassware/equipment used in the preparation of standards (volumetric flasks, pipettes, beakers, eppendorf tips are rinsed well with the appropriate solvent and allowed to dry before use. After completion of standard preparation, unused amounts of standards are properly disposed of, and all glassware/equipment rinsed well with the appropriate solvent. Rinse/excess solvent is properly collected and disposed of. These procedures should eliminate positive interferences from these sources.
- All glassware used must be scrupulously clean prior to use. All re-usable glassware must be washed following procedures described in the laboratory glassware cleaning SOP (UQA-009). All glassware must also be rinsed at least 3 times with the appropriate solvent.
- Tetryl decomposes rapidly in methanol/water solutions, as well as with heat. All samples expected to contain Tetryl should **not** be exposed to temperatures above room temperature and not above 10°C when diluted for injection. It is imperative that the automatic liquid samplers employed have the capability of being chilled to <10°C to minimize Tetryl degradation while standards and samples are awaiting analysis.

3.0 SAFETY

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

3.1 Specific Safety Concerns or Requirements

- 2,4,6-TNT is the analyte most often detected in high concentrations in soil samples. Soil samples as high as 2% 2,4,6-TNT can be safely ground. Samples containing higher concentrations should **not** be ground. The project manager or client must provide information as to whether the samples are suspected to contain explosives at a level greater than 2%. Visual observation of soil samples taken from a site expected to contain explosives is also important. Lumps of material that have a chemical appearance should be suspect and not ground. Explosives are generally a very finely ground grayish-white material.
- Parts of the instrument can be hot. Care should be taken if the instrument needs to be adjusted internally.

3.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. NOTE: **This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Acetonitrile	Flammable Poison	40 ppm-TWA	Early symptoms may include nose and throat irritation, flushing of the face, and chest tightness. Prolonged exposure to high levels of vapors may cause formation of cyanide anions in the body.
Methanol	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

4.0 EQUIPMENT AND SUPPLIES

4.1 Supplies

- Disposable luer-lock filters - 0.20 um Teflon® filter
- Pipettes: 10-mL, 9-mL, 5-mL, 1-mL glass, volumetric, Class A
- Pasteur pipettes
- Disposable 10-mL syringe with Luer-Lock fitting
- 6x125mm screw-top (Teflon-lined) test tubes
- 1.5-mL amber autosampler vials
- Eppendorfs: 100 uL-1000 uL size (adjustable)
- Air-forced drying oven
- Volumetric flasks (glass, Class A): 5.0-mL and 10.0-mL
- 1.0 L Erlenmeyer flask
- 125-mL Erlenmeyer flask
- Magnetic stir bars
- Automatic magnetic stirrer
- Muffle furnace capable of 400°C

- Temperature-controlled ultrasonic bath
- Water chiller recirculator capable of achieving <10°C
- Balance, ± 0.1 mg
- Vortex, VWR, Vortex Genie 2, or equivalent
- Vacuum Pump
- Strata SPE Manifold

4.2 HPLC System

- 4 - Agilent 1100 HPLCs equipped with UV detectors and autosampler with a refrigerated water circulator capable of chilling extracts to <10°C.

4.2.1 HPLC Columns

- Primary Column: Phenomenex Ultracarb (C18), 5u ODS (20); 250 x 4.6mm ID
- Confirmation Column: Phenomenex Luna 3u Phenyl-Hexyl 150 x 4.6mm ID

4.2.2 HPLC Conditions

Primary Column	Secondary Column
Phenomenex Ultracarb (C18), 250 x 4.6 mm ID, 5 micron particle size, normal phase.	Phenomenex Luna Phenyl Hexyl, 150x4.6mm ID, 3 micron particle size, reverse phase
Mobile Phase: 50% water / 45% MeOH / 5% ACN*	Mobile Phase: 59% 0.1% H3Po4/ 41% 9:1 MeOH / ACN *
Flow Rate: 1.0 mL/min*	Flow Rate: 1.0 mL/min*
Injection volume: 100 uL*	Injection Volume: 100 uL*
UV Detector: 254 nm*/**	UV Detector: 254 nm*/**
Column Temperature: 30°C	Column Temp.: 35°C
Range 0.100 Au	Range: 0.200 Au

* Conditions may be varied to achieve optimum separation.
** When analyzing for NG and PETN a wavelength of 210 nm must be used for C18 column and a wavelength of 214 nm for the Phenyl Hexyl column.

4.2.3 Data Collection

Each HPLC uses TurboChrom for data acquisition and Target for processing data.

5.0 REAGENTS AND STANDARDS

5.1 Reagents

- Laboratory pure water (Milli-Q)
- Methanol (MeOH) - HPLC grade or better
- Acetonitrile (ACN) - HPLC grade or better
- Sodium Chloride, NaCl, Reagent grade. Kilned at 400°C for 4 hours. Stored in glass bottles.

5.2 Standards

Stock standards are purchased as solutions generally from Restek and Cerrilant. When available, standards with A2LA, CRADA or EPA certifications are purchased. If unavailable, the standards are verified against an alternate source.

These solutions are purchased at concentrations such that appropriate dilution's can be made to achieve desired concentrations. When making stock solutions for calibration, treat each explosive compound with caution.

The preparation of all standards and QC solutions must be properly documented. All standards and QC solutions must be labeled with the date of preparation, expiration date, analyst, and concentrations of analytes. Standards must be stored in glass containers with Teflon-lined lids at 4±2°C protected from the light. Stock standards must be replaced after 1 year, or sooner if comparison with a check standard indicates a problem.

5.2.1 Parent Surrogate Solution: 20 ug/mL

The surrogate solution (1,2-Dinitrobenzene) is purchased from a vendor at a concentration of 1,000 ug/mL. The Parent Surrogate Solution is prepared by diluting 1-mL of surrogate with ACN to a final volume of 50-mL. This produces a final concentration of 20 ug/mL.

5.2.1.1 Working Surrogate Solution: 2 ug/mL

The Working Surrogate Solution is prepared by volumetrically diluting 5.0-mLs of the Parent Surrogate to 50.0-mLs of ACN (1/10 dilution), resulting in a concentration of 2.0-ug/mL. 600 uLs is added to water samples; and 1.0 mL is added to soil samples.

- Label Information: All standard labels must contain the date prepared, the date of expiration, the analyst name, and the standard number.
- Storage / Life: All standard and spikes must be stored in Teflon-sealed screw-capped bottles with minimal headspace at 4 ± 2°C and protected from light. This solution is valid for 30 days.

5.2.2 Parent Spike Solution
[Laboratory Control Sample (LCS) and Matrix Spike (MS)/MS Duplicate (MSD)]

Two different explosive spike mixes are purchased from a vendor for the preparation of the working spike solution.

Mix #1	Mix #2
HMX	Tetryl
RDX	2,6-Dinitrotoluene
1,3,5-Trinitrobenzene	2-Nitrotoluene
1,3-Dinitrobenzene	3-Nitrotoluene
Nitrobenzene	4-Nitrotoluene
TNT	2-Amino-4,6-DNT
2,4-Dinitrotoluene	4-Amino-2,6-DNT

Their concentrations are 1,000-ug/mL. The Parent Spike is prepared by adding 1.0-mLs of Mix #1 and 2.0-mLs of Mix #2; and brought up to a final volume of 50-mL in ACN. The final concentrations are 20 ug/mL (Mix #1) and 40 ug/mL (Mix #2). Independently, PETN and NG are prepared in the same manner using 1.0-mL of each to a final volume of 25-mL giving a final concentration of 40 ug/mL.

5.2.2.1 Working Spike Solution: 2.0 ug/mL / 4.0 ug/mL

The Working Spike Solution is prepared by diluting 1.0 mL of the Parent Spike Solution to 10.0 mLs ACN (1/10 dilution). The final concentrations are 2.0 / 4.0 ug/mL (Attachment 2). 600 uLs are added to water samples and 1 mL is added to soil samples.

- Label Information: All standard labels must contain the date prepared, the date of expiration, the analyst name, and the standard number.
- Storage / Life: All standard and spikes must be stored in Teflon-sealed screw-capped bottles with minimal headspace at $4 \pm 2^{\circ}C$ and protected from light. This solution is valid for 30 days.

5.2.3 Parent Calibration Standards

Calibration standards are prepared in ACN. One of the concentration levels should be at, or below a concentration equivalent to the reporting limit. The remaining concentration levels should correspond to the expected range of concentrations found in real samples or should define the working range of the HPLC. Explosive standards are purchased individually from a vendor for the preparation of the intermediate solutions Mix #1 and Mix #2.

Mix #1	Mix #2
HMX	Tetryl
RDX	2,6-Dinitrotoluene
1,3,5-Trinitrobenzene	2-Nitrotoluene
1,3-Dinitrobenzene	3-Nitrotoluene
Nitrobenzene	4-Nitrotoluene
TNT	2-Amino-4,6-DNT
2,4-DNT	4-Amino-2,6-DNT

Their concentrations are 1,000 ug/mL. The Parent standard is prepared by adding 0.5-mL of Mix #1, 1.0-mL of Mix #2, and 0.5-mL of the surrogate. Dilute to a final volume of 50-mL in ACN. The resulting concentrations are listed in Attachment 2. NG and PETN are made independently using 1.0-mL of each and 0.5-mL of the surrogate to a final volume of 50-mL in ACN.

- Label Information: All standard labels must contain the date prepared, the date of expiration, the analyst name, and the standard number.
- Storage / Life: All standard and spikes must be stored in Teflon-sealed screw-capped bottles with minimal headspace at $4\pm2^{\circ}C$ and protected from light. This solution is valid for 30 days.

5.2.3.1 Working Calibration Standards

6-concentration levels are prepared through dilution of the Parent Calibration Standard and are prepared fresh on the day of calibration. The resulting calibration range in relative concentrations ranges from 0.02/0.04 ng/uL through 1.0/2.0 ng/uL. Refer to Attachment 2 for a listing of the concentrations.

- Label Information: All standard labels must contain the date prepared, the date of expiration, the analyst name, and the standard number.
- Storage / Life: All standard and spikes must be stored in Teflon-sealed screw-capped bottles with minimal headspace at $4\pm2^{\circ}C$ and protected from light. This solution is valid for 30 days.

5.2.4 Continuing Calibration Verification (CCV)

The CCVs are alternating mid-level standards; and the concentrations are consistent with the cited Levels 4 and 5 concentrations listed in Attachment 2.

- Label Information: All standard labels must contain the date prepared, the date of expiration, the analyst name, and the standard number.
- Storage / Life: All standard and spikes must be stored in Teflon-sealed screw-capped bottles with minimal headspace at $4 \pm 2°C$ and protected from light. This solution is valid for 6 mos..

5.2.5 Second Source Verification (SSV)

The SSV is second-source standard consistent with the Level 5 concentration listed in Attachment 2. (Some clients request the SSV at the Level 2 concentration).

- Label Information: All standard labels must contain the date prepared, the date of expiration, the analyst name, and the standard number.
- Storage / Life: All standard and spikes must be stored in Teflon-sealed screw-capped bottles with minimal headspace at $4 \pm 2°C$ and protected from light. This solution is valid for 6 mos..

6.0 CALIBRATION (NON-DAILY)

Explosives are confirmed by use of a second column (Section 4.2.2). The acceptance criteria for this analysis is identical to that of the primary column.

6.1 Retention Time Windows

Before establishing retention time (RT) windows, make sure the HPLC system is within optimum operating conditions. Make 3-injections of a standard throughout the course of a 72-hour period. Serial injections over less than a 72-hour period may result in retention time windows that are too tight.

$\pm$ 3X Standard Deviation of the absolute RTs for each standard will be used to define the RT window; however, the experience of the analyst should weigh heavily in the interpretation of chromatograms.

The laboratory must calculate RT windows for each analyte on each LC column and whenever a new LC column is installed. The data must be retained by the laboratory and available for review.

7.0 PROCEDURE

7.1 Quality Control Checks

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< Reporting Limit
Lab Control Sample (LCS)	1 in 20 or fewer samples	Statistical control limits [4]
LCS Duplicate (LCD) [1]	1 in 20 or fewer samples	Statistical control limits
Matrix Spike (MS) [2]	1 in 20 or fewer samples	Statistical control limits
MS Duplicate (MSD) [2]	1 in 20 or fewer samples	Statistical control limits
Surrogate	every sample [3]	Statistical control limits

[1] LCDs are performed only when insufficient sample is available to perform the MS/MSD or when requested by the client/project/contract.
[2] If not designated, the sample selection for MS/MSD are rotated among client samples so that various matrix problems may be noted and/or addressed.
[3] Analytical and QC samples.
[4] Internal statistical control limits are updated; refer to Attachment 1.

7.2 Sample Preservation and Storage

Samples are to be collected in glass containers with Teflon-lined lids. All samples are to be maintained at 4±2°C, in the dark, prior to and after extraction/analysis.

Matrix	Holding Time (VTS): (to Extract)	Holding Time: (Extraction to Analysis)
Soil / Sediment	14 days	40 days
Water	7 days	40 days

VTS: Verified Time of Sampling

7.3 Sample Preparation

7.3.1 Reverse Salt-Out Extraction (Low - Level Waters)

7.3.1.1 Measure out 770 mL of sample (using a 1-liter graduate) and transfer it to a 1-liter narrow neck Erlenmeyer flask, or 1-liter volumetric flask. Add 251.3 g of NaCl (kilned at 400°C for 4 hours) to the sample. Add a stir bar and mix the contents at maximum speed on a magnetic stirrer until the salt is completely dissolved.

7.3.1.2 Using an adjustable microdispenser, add 600 uLs of working surrogate solution to each sample, MB, LCS, and MS/MSD. Add 600 uLs of working spike solution to the LCS and MS/MSD.

7.3.1.3 Continue the stirring motion and add 164 mLs HPLC grade ACN. Stir for 15 minutes. Allow the phases to separate for 10 minutes. Remove the top ACN layer (about 8 mLs) with a Pasteur pipette and transfer it to a 125 mL narrow neck Erlenmeyer flask, or a 100 mL volumetric flask.

7.3.1.4 Add 10 mLs of fresh ACN to the original sample and stir for 15 minutes. Allow the phases to separate for 10 minutes. Remove the top ACN layer and add to the Erlenmeyer containing the original ACN extract.

7.3.1.5 Add 84 mLs of saturated salt solution (325.1 g NaCl/1 L H_2O) to the 125 mL Erlenmeyer containing the ACN sample extract. Stir for 15 minutes. Allow to separate for 10 minutes.

7.3.1.6 Remove the top ACN layer and add it to a graduated test tube which accurately measures <10.0 mL. (It is imperative at this point to not allow the transfer of any saturated salt solution with the ACN.)

7.3.1.7 Add 1.0 mL fresh ACN to the Erlenmeyer and stir for 15 minutes. Allow to separate for 10 minutes. Remove the top ACN layer from the Erlenmeyer and add to the first extraction aliquot in the graduated test tube.

7.3.1.8 Adjust the final volume to 6 mLs. On occasion, the final volume ends up being greater than 6 mLs. Document the final volume appropriately.

7.3.1.9 Filter the extract through a 0.2 um Teflon filter prior to analysis.

7.3.1.10 All sample extracts and standards are diluted 1:1 with filtered Milli-Q water prior to analysis on the C18 column. All sample extracts and standards are diluted 1:2 with filtered Milli-Q water prior to analysis of the Phenyl Hexyl column.

7.3.2 High-Level Waters (Option)

Sample filtration: Place a 5 mL aliquot of each water sample in a 16x125mm test tube. Add 5 mLs of ACN, shake thoroughly, and filter through a 0.2 um Teflon filter using a disposable syringe. Discard the first 3 mLs of filtrate, and retain the remainder in a Teflon-capped vial for HPLC analysis.

7.3.3 Soil and Sediment Samples

7.3.3.1 Dry a homogenized, representative portion of each soil sample in an air-forced drying oven being careful not to expose the sample to direct light - soils/sediments are dried to a constant weight. Add the MB soil (Ottawa sand) into the oven along with the samples. This will ensure no cross contamination occurs during the drying process.

Pulverize the dried sample with a mortar and pestle. It is imperative that the mortar and pestle be rinsed thoroughly between samples to prevent the possibility of cross contamination. With a spatula, remove any sticks, rocks or other extraneous material. Particle size should resemble soil passed through a 30 mesh sieve.
NOTE: See safety section regarding extraction of wet soils for high level samples.

7.3.3.2 Weigh a 2.0 g aliquot of each dry, pulverized, soil sample into a properly labeled, 16x125mm screw-top test tube. Add 1.0 mL of working surrogate solution to each sample, MB, LCS, and MS/MSD. Add 1.0 mL of working spike solution to each sample, LCS, and MS/MSD. Add ACN to achieve a final volume of 10.0 mLs. Cap with a Teflon-lined screw cap. Vortex each sample for 1 minute. Store the extra, pulverized sample in small, labeled vials for future use, if needed.

7.3.3.3 Place the test tubes (contained in a test tube rack) in an ultrasonic bath and extract for 18 hours.

7.3.3.4 To minimize Tetryl breakdown, the ultrasonic bath must be chilled to <10°C. This may be achieved by running a line from the water chiller recirculator into the bath to chill the bath to <10°C.

7.3.3.5 After sonication, centrifuge each sample tube to separate the soil from the extract. Place the supernatant in a disposable syringe and filter through a 0.2 micron Teflon-filter. Sample is then prepared for instrument as is Section 7.3.1.10

7.3.3.6 Solid Phase Extraction (SPE) Method 3535 (See Attatchment 6).

7.4 Calibration / Standardization

Before any instrument is used as a measurement device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated depends on the particular type of instrument and its intended use. All sample measurements must be made within the calibration range of the instrument. Preparation of all reference materials used for calibration must be documented.

Calibration Controls	Sequence	Control Limit
Calibration Standards	5-point (minimum) curve	$\leq$ 20% RSD
Cont. Cal. Verif. (CCV)	Prior to and after every 10 injections	$\pm$15% pred. response
RT Windows (RTW)	Initial CCV determines midpt. of RTW	$\pm$ 3X SD

All standards and samples must be allowed to equilibrate in the autosampler chiller prior to analysis.

All electronic equipment is allowed to warm up for 30-minutes. During this period, at least 15 void volumes of mobile phase are passed through the column (~20 min at 1.5 mL/min) and continued until the baseline is level.

7.4.1 Instrument Calibration

7.4.1.1 Prepare a minimum of 5 levels of calibration standards (Attachment 2). The calibration standards define the working range of the HPLC with the lowest standard being at or below the reporting limit.

7.4.1.2 Inject each calibration standard using the same sample introduction technique that will be used to introduce the actual samples into the HPLC. The ratio of the response to the amount injected, defined as the calibration factor (CF), can be calculated for each analyte at each standard concentration. If the percent standard deviation (%RSD) of the calibration factors is $\leq$ 20%, linearity through the origin can be assumed and the average response factor (RF) can be used for calculations. Alternatively, if a correlation coefficient of $\geq$0.995 is obtained, linear regression may be used for calculating compounds.

$$\text{Calibration Factor} = \frac{\text{Peak Area (or Height)}}{\text{Mass injected (nanograms)}}$$

$$\text{Response Factor (RF)} = \frac{\text{Concentration}}{\text{Peak Area (or Height)}}$$

7.4.1.3 The working calibration curve, or calibration factor, must be verified on each working day by injecting the alternating CCVs (mid-level standards). If the response for any analyte varies form the predicted response by more than $\pm$15% Difference, a new calibration curve must be prepared for that analyte, unless maintenance can be performed which brings the instrument back into control.

7.4.1.4 Calibration Evaluation and Acceptance Criteria

Refer to the STL Corporate Procedure, P-T-001, 'Selection of Calibration Points' (Attachment 3) or on STLs Intranet.

7.5 Preventive Maintenance

- Laboratory pure water must be filtered, using an all-glass apparatus, through 0.2um filter prior to use on the instrument.
- If peak splitting occurs, an increase in pressure is usually seen. The source of the increase is most likely a plugged purge valve frit or pre-column filter. The column itself may be the source of increased pressure. This is easily checked by substitution with a known good column. As a last resort the column's internal frit may be changed. Care should be taken not to disturb the column's packing. Disturbance of the packing may result in voids within the column and channeling.

7.6 Sample Analysis

7.6.1 Samples are analyzed in a set referred to as an analytical sequence. This sequence begins with the analysis of a CCV. If comparison of the CF from the CCV are within $\pm$15% difference of the average CF from the calibration curve, then the analysis sequence may proceed with a MB, followed by the LCS and then the samples. If the CF of the CCV is greater than $\pm$15% difference, a new calibration sequence must be analyzed.

7.6.2 A CCV must be injected after every 10 injections. The CF for each analyte to be quantitated must not exceed a 15% difference when compared to the initial calibration sequence. When this criterion is exceeded, inspect the HPLC system to determine the cause and perform whatever maintenance is necessary before re-analyzing the standard. If the CF still exceeds the 15% difference criteria, a new calibration sequence is required. All samples must be bracketed by standards that are within control.

7.6.3 If the response of any sample exceeds the linear range of the system, dilute the sample and re-analyze.

7.6.4 Establish daily RT windows for each analyte. Use the absolute RT for each analyte from the beginning of the sequence as the midpoint of the window for that day. The daily RT window equals the midpoint $\pm$ 3X the standard deviation (Sec. 6.1).

7.6.5 Tentative identification of an analyte occurs when a peak from a sample extract falls within the daily RT window. Confirmation is required on a second HPLC column. When at sufficient concentrations, GC/MS confirmation may be used.

7.6.6 Validate the qualitative performance of the HPLC system by running the alternating mid-level CCVs throughout the analysis sequence to evaluate this criterion. If any of the standards fall outside their daily retention time window, the system is out-of-control. Determine the cause of the problem and correct it.

7.7 Manual Integration Policy

In each case where manual integrations have taken place, the operator must identify, initial and date the changes on the hardcopy. The following guidelines apply with further details available in STLs Corporate SOP for manual integrations (S-Q-004).

- Manual integrations should be consistent between all files integrated.
- Manual integrations should not be performed to meet QC criteria.
- Manual integrations are automatically flagged with an 'M' on the raw data.
- Excessive manual integrations may reflect an instrumental or methodological problem that should be addressed.

Manual integrations are most often performed for the following reasons:

- Assignment of correct peak that was mis-identified by the data system.
- Incomplete auto-integration due to high level of target compound detected.
- Incomplete auto-integration due to background interference.
- Incorrect auto-integration due to co-elution or near co-elution of compounds.
- Missed peaks.

All integrations are reviewed by the analyst. All chromatograms and reports are printed after any integrations take place and are routinely included in the data packages. Manual integrations may be documented within the narrative (if so required), however, reference to this and the Corporate Manual Integration SOP will be used for explanations and any further documentation beyond initials and dates will not be done.

7.8 DOCUMENTATION

7.8.1 Instrument Run Logs

The analysis of samples and standards is documented within each instrument-specific run log (Attachment 4), and must be completed for each day's analysis.

7.8.2 Traceability of Standards

Upon receipt or preparation, each standard is entered into LabNet (LIMS) and is issued a unique ID# based upon the type and sequential order in which the item was received. Further information entered into the database includes the manufacturer, lot #, the date received or prepared, the expiration date, volume/weight received; concentration; preparation details (if applicable), initials of the recording analyst, and the description of the item (i.e., **XXXX** Stock Solution – LCS/MS). Once the record is created, a unique label is printed and affixed to the appropriate standard bottle.

7.8.3 Data Review

Analytical data goes through a 200% review cycle. The analyst and a trained data reviewer perform the reviews according to the criteria established on the data review checklist (Attachment 5). Upon the first 100% review, the checklist is initialed and dated as reviewed. The package, with its checklist, comments and any CARs, is submitted to the section manager or peer reviewer for a second review. Once again, the checklist is initialed and dated by the second reviewer. The completed data review checklist remains on file with the original data

8.0 QUALITY CONTROL

8.1 QC Summary

8.1.1 At least one MB and LCS will be included in each laboratory lot of 20 or fewer samples. The MB will be examined to determine if contamination is being introduced in the laboratory. The MB and LCS must be carried through all stages of the sample preparation and measurement steps. The results of these are tabulated by the QA department to generate in-house control limits.

8.1.2 Accuracy will be measured by the percent recovery (%R) of the LCS. The recovery must be in range, as determined by statistical analysis, in order to be considered acceptable. Additionally, %R will be plotted on control charts to monitor method accuracy.

8.1.3 Precision will be measured by the reproducibility of the MSs and will be calculated as Relative Percent Difference (RPD). If MSs were not analyzed, reproducibility will be measured using the LCS/LCD. Results must agree within statistical control limits in order to be considered acceptable.

8.1.4 Surrogate compounds will be added to every analytical and QC sample to measure the performance of the analysis. Results must agree within statistical control limits in order to be considered acceptable.

8.1.5 Each time an analytical sequence is started, the standards must be evaluated to determine if the chromatographic system is operating properly. The analyst should consider--Do the peaks look normal?, is the response obtained comparable to the response from previous calibrations? Careful examination of the standard chromatograms can indicate whether the column is still good, the injector is leaking, etc....

8.1.6 The laboratory must maintain records to document the quality of the data generated. When results of the LCS indicate irregular method performance, a quality control check standard should be analyzed to confirm that the measurements were performed in an in-control mode of operation.

8.1.7 Before analysis of any samples, the analyst should demonstrate, through the analysis of a MB that interference from the analytical system, glassware and reagents are under control.

8.1.8 If any changes are made to the chromatographic system, recalibration of the system must take place.

8.1.9 Required Instrument QC

- The method requires that the %RSD vary by <20% when comparing calibration factor to determine if a five (or more) point calibration is linear through the origin. If the %RSD is <20%, the average CF from the calibration can be used to quantitate the samples. Alternatively, linear regression can be used to quantitate the samples; however, a correlation coefficient of 0.995 should be achieved prior to using the curve.
- CCVs must be within ±15% difference from the average CF of the linearity. If the limit is exceeded, corrective action must be taken to correct the problem, or the sequence must be started over. All samples should be bracketed by acceptable CCVs and all analytical runs are closed-out with a CCV. There are situations where if samples are clean, and a CCV displays an increase in sensitivity, the samples don't have to be re-analyzed. This issue must be dealt with on a case-by-case situation and must be documented and approved prior to reporting any data.
- RT windows must be established.
- All continuing standards must fall within their daily RT windows.
- For every batch of samples (≤ 20 samples/batch), a MB, LCS, and MS/MSD must be performed. Also, every sample, MB, LCS, MS/MSD must be spiked with the surrogates.
- Limits used for spike recoveries are statistically generated limits, or limits which have been specifically requested by the client (refer to project QAP).

8.2 Corrective Action

When an out-of-control situation occurs, the analysts must use his/her best analytical judgment and available resources when determining the action to be taken. The out-of-control situation may or may not be caused by more than one problem. The analyst should seek the help of his/her supervisor, QA personnel, or other experienced staff if he/she are uncertain of the cause of the out-of-control situation and the corrective action. The analysis must not be resumed until the source of the problem and an in-control status is attained. All samples associated with the out-of-control situation must be reanalyzed. Out-of-control data must never be released without approval of the section manager, QA personnel, or the laboratory manager.

Listed below are steps that MUST be taken when an out-of-control situation occurs:

- demonstrate that all the problems creating the out-of-control situation were addressed,
- document the problem and the action which was taken to correct the problem on a corrective action report (CAR) form,
- document on the CAR that an in-control situation has been achieved; and
- receive approval (signature) of the section manager, QA personnel, or the laboratory manager prior to release of any analytical data associated with the problem.

NOTE: See your section manager if at any time the analyst is uncertain as to what actions to take or how to perform suggested maintenance; or if something unusual is happening that is not described in this section. Costly damage can result to the instrument, detector, or column if maintenance is not performed correctly.

8.2.1 Calibration Curve

- Reanalyze the standard curve.
- Prepare new stock and/or working standards.

8.2.2 Continuing Calibration Verification (CCV)

- Repeat CCV to verify proper preparation.
- Prepare new CCV from original stock.
- Check for instrument drift.
- Recalibrate with new standard curve and repeat all samples since the previous in-control CCV.
- Prepare new stock and/or working standards.

8.2.3 Laboratory Control Sample (LCS)

If the LCS is low

- Re-inject the extract to ensure the error wasn't an injection error.
- Determine the source of the error, re-extraction of the entire set may be necessary. Initiate a Sample Discrepancy Report (SDR) so the project manager or section manager can determine if re-extraction is required.

If the LCS is high

- Re-inject the extract to ensure the error wasn't an injection error.
- Check for source of possible contamination, re-extraction of the entire set may be necessary.
- Initiate an SDR so the project manager or section manager can determine if re-extraction is required. If all samples are non-detects, this situation may be able to be narrated.

8.2.4 Method Blank (MB)

The MB should not have any target compounds present above the reporting limit.

- Re-inject the MB to verify that the contamination is not within the chromatographic system.
- Determine the level of contamination in the MB and in the associated samples. If the associated samples are either non-detects, or have the same target compound as the MB at a level >10 times what was in the MB, the data may be acceptable to report.
- Initiate an SDR immediately, so that the project manager or section manager can determine if re-extraction is necessary.

8.2.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

- Re-inject the extracts to ensure the error wasn't with the injection.
- If both the MS/MSD are biased low, or both are biased high, and the RPD is within control, sample matrix may be assumed as the cause.
- Otherwise, initiate an SDR so that the appropriate actions can be taken. Re-extraction may be required.

8.2.6 Retention Time Windows

Initial RT windows must be established following the procedure described in Section 6. Daily windows are established (Section 7.6.4) at the beginning of each analytical sequence. If a continuing standard has any analytes that are outside of their daily windows, corrective actions must be taken before continuing.

- Evaluate the data for usability based on a comparison with the standards run during the analytical sequence.
- Consider the RTs for the surrogates and spiked compounds analyzed before and after the sample in question.
- Check the instrument for leaks, check flows, and pressures.
- Document using a CAR.

8.2.7 Surrogate Spike

The recoveries for the surrogate(s) should be within statistical control limits.

- Check calculations and spike preparation for documentable errors.
- If the surrogate recoveries in the MB and LCS are within the control limits, then sample matrix effects are the most likely cause. However, any samples with surrogate recoveries significantly below the control limits with, no visible chromatographic cause, should be reanalyzed to determine if an injection error was the cause for the low recovery.

- If the surrogate recoveries in the associated MB and LCS are not within control limits, and the samples are within the holding time, then re-extract all associated samples.
- If the samples are outside the holding time, then contact the project manager using and SDR.

Unless otherwise directed, samples will not be re-analyzed out of hold time and data will be submitted with appropriate narration.

8.2.8 Continuing Calibration Verification (CCV)

Alternating mid-level CCVs are run after every 10 sample injections. The response factors of the CCV should not vary from the average response factor of the initial calibration by more than ±15%. If any of the target compounds fail this criteria, then the standard is considered to be non-compliant.

- Re-analyze the standard.
- If the standard is still non-compliant, then prepare a new standard.
- If the new standard is non-compliant, then recalibrate the instrument with a new curve.
- Any samples bracketed by a standard that does not meet this criteria, must be reanalyzed.
- Notify the project manager of any non-compliance using the SDR.

Unless directed otherwise, samples will not be analyzed outside of holding time and the data will be submitted with appropriate narration.

9.0 DATA ANALYSIS AND CALCULATIONS

9.1 Concentration (ppb)

$$\text{Concentration (ppb)} = \frac{[(A_1)(A)(V_t)(D)]}{[(A_2)(V_i)(V_s)]}$$

Where:
A_1 = response for the analyte in the sample (area or height)
A = amount of standard injected (ng)
A_2 = average CF for the linearity (area or height, which ever was used for A1)
V_i = volume of extract injected
D = dilution factor
V_t = volume of total extract (uL)
V_s = volume/weight of sample extracted.

9.2 %RSD $= \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$

Where:

$$\text{Std. Dev.} = \frac{\left| \sum_{i=1}^{n} (x_i - \bar{x})^2 \right|^{1/2}}{n - 1}$$

Where:
x_i = each individual value used to calculate the mean
$\bar{x}$ = the mean of n values
n = the total number of values

9.3 % Difference $= \frac{\text{Avg. CF} - \text{CF}}{\text{Avg. CF}} \times 100$

Where:
Avg. CF = Average CF from initial linearity
CF = CF from the analysis of the verification standard

9.4 Surrogate % Recovery $= \frac{Q_d}{Q_a} \times 100$

Where:
Q_d = Quantity determined by analysis
Q_a = Quantity added to sample/blank

9.5 Spike %Recovery $= \frac{SR}{SA} \times 100$

Where:
SR = Spike Result
SA = Spike Added

9.6 Accuracy (%R) $= \frac{(A_T - A_O)}{A_F} \times 100$

Where:
A_T = Total amount recovered in the fortified sample
A_O = Amount recovered in the unfortified sample
A_F = Amount added to sample

9.7 Precision (RPD) $= \frac{| B_1 - B_2 |}{(B_1 + B_2) / 2} \times 100$

Where:
B_1 = % Recovery MS (or LCS)
B_2 = % Recovery MSD (or LCD)

NOTE: All dry weight corrections are made in LabNet at the time the final report is prepared.

10.0 WASTE MANAGEMENT AND POLLUTION CONTROL

All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

10.1 Waste Streams Produced by the Method

The following waste streams are produced when this method is carried out.

- Solid sample waste will be placed in the "Non-Hazardous" waste buckets.
- Acetonitrile/Methanol/Water mixture will be collected in approved containers and poured into the drum labeled "Flammable Solvent" waste using a funnel to reduce splashing.
- Expired and single component standards will be turned over to the EHSC or Waste Technician.

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Section 1.0

13.0 ATTACHMENTS

Table 1. Retention Times

Attachment 1. Example: Reporting Limits, MDLs, and Statistical Control Limits
Attachment 2. Standards; Working Spike and Working Surrogate Concentrations
Attachment 3. STL Corporate Procedure, P-T-001, 'Selection of Calibration Points'
Attachment 4. Example: Analysis Run Log / Maintenance Log
Attachment 5. Example: Data Review Checklist
Attatchment 6. Solid Phase Extraction (SPE) Method 3535

Historical File:		
	Revision 00: 09/09/94	Revision 05: 05/14/99
	Revision 01: 09/28/94	Revision 06: 04/18/00
	Revision 02: 10/24/96	Revision 07: 03/28/02
	Revision 03: 06/17/97	Revision 08: 02/17/04
	Revision 04: 12/30/98	Revision 09: 03/30/05

Revision 09; Reasons for Change:

- Annual Review
- Added 1.2.4 SPE section
- Section 2.0 added bullet for glassware
- 3.2 Added MeCl to list
- 4.1 added to supplies
- 5.2 Updated vendors
- 5.2.2 updated amounts used
- 6.0 removed statement about co-elutions
- 7.3.1.10 updated columns
- 7.3.3.5 refer to section 7.3.1.10 for sample instrument prep
- 7.3.3.6 added section for SPE method 3535
- Added Attachment 6, SPE Method 3535

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Table 1.

Example: Retention Times (minutes)

Compound	C18 Column	Phenyl Hexyl Column
HMX	4.48	17.50
RDX	6.71	12.28
1,3,5-Trinitrobenzene	9.15	11.54
1,3-Dinitrobenzene	11.07	10.14
Nitrobenzene	12.44	8.84
2,4,6-Trinitrotoluene	15.24	15.68
Tetryl	13.25	15.68
2,4-Dinitrotoluene	17.95	12.64
2-Amino-4,6-Dinitrotoluene	16.50	13.70
2,6-Dinitrotoluene	17.49	12.64
4-Amino-2,6-Dinitrotoluene	15.84	13.38
2-Nitrotoluene	20.96	10.83
4-Nitrotoluene	22.63	10.83
3-Nitrotoluene	24.34	11.12
1,2-Dinitrobenzene (surrogate)	9.55	12.06
Nitroglycerine**	14.60	*
PETN**	29.4	*

*To be determined
**Analyzed at a wavelength of 210 nm

Attachment 1.

Example: Reporting Limits, MDLs, and Statistical Control Limits

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Method Limit Report
04/04/2005

V2

Method Limit Report using report code 8330   Explosives by 8330 (HPLC) (8330)

Test Long Description	TMX	Units	Limits MDL	RL	LCSLL	LCSUL	LCSRPD	SLL	SUL
1,2-Dinitrobenzene (surr)		ug/L						66	144
1,3-Dinitrobenzene		ug/L	0.033	0.16	79	115	20		
1,3,5-Trinitrobenzene		ug/L	0.039	0.16	77	130	20		
2-Amino-4,6-Dinitrotoluene		ug/L	0.035	0.31	87	117	20		
2-Nitrotoluene		ug/L	0.082	0.31	77	113	20		
2,4,6-TNT		ug/L	0.036	0.16	75	145	20		
2,4-Dinitrotoluene		ug/L	0.032	0.31	81	116	20		
2,6-Dinitrotoluene		ug/L	0.071	0.31	85	115	20		
3-Nitrotoluene		ug/L	0.137	0.31	80	112	20		
4-Amino-2,6-Dinitrotoluene		ug/L	0.074	0.31	87	117	20		
4-Nitrotoluene		ug/L	0.082	0.31	76	113	20		
HMX		ug/L	0.122	0.31	82	116	20		
MNX		ug/L	0.064	0.16	74	117	20		
Nitrobenzene		ug/L	0.032	0.16	81	106	20		
RDX		ug/L	0.077	0.16	86	124	20		
Tetryl		ug/L	0.065	0.39	84	118	20		
~~1,2-Dinitrobenzene (surr)~~		~~ug/L~~						~~66~~	~~144~~
1,3-Dinitrobenzene		ug/L	0.033	0.16	79	115	20		
1,3,5-Trinitrobenzene		ug/L	0.039	0.16	77	130	20		
2-Amino-4,6-Dinitrotoluene		ug/L	0.035	0.31	87	117	20		
2-Nitrotoluene		ug/L	0.082	0.31	77	113	20		
2,4,6-TNT		ug/L	0.036	0.16	75	145	20		
2,4-Dinitrotoluene		ug/L	0.032	0.31	81	116	20		
2,6-Dinitrotoluene		ug/L	0.071	0.31	85	115	20		
3-Nitrotoluene		ug/L	0.137	0.31	80	112	20		
4-Amino-2,6-Dinitrotoluene		ug/L	0.074	0.31	87	117	20		
4-Nitrotoluene		ug/L	0.082	0.31	76	113	20		
HMX		ug/L	0.122	0.31	82	116	20		
MNX		ug/L	0.064	0.16	74	117	20		
Nitrobenzene		ug/L	0.032	0.16	81	106	20		
RDX		ug/L	0.077	0.16	86	124	20		
~~Tetryl~~		~~ug/L~~	~~0.065~~	~~0.39~~	~~84~~	~~118~~	~~20~~		

Method Limit Report using report code 8330 Explosives by 8330 (HPLC) (8330)

Test Long Description	TMX	Units	Limits MDL	RL	LCSLL	LCSUL	LCSRPD	SLL	SUL
1,2-Dinitrobenzene (surr)	Solid	ug/Kg						80	121
1,3-Dinitrobenzene	Solid	ug/Kg	5.0	100.	86	112	30		
1,3,5-Trinitrobenzene	Solid	ug/Kg	7.0	100.	82	125	30		
2-Amino-4,6-Dinitrotoluene	Solid	ug/Kg	6.4	200.	90	112	30		
2-Nitrotoluene	Solid	ug/Kg	17.0	200.	88	114	30		
2,4,6-TNT	Solid	ug/Kg	14.7	100.	67	152	30		
2,4-Dinitrotoluene	Solid	ug/Kg	7.9	100.	87	114	30		
2,6-Dinitrotoluene	Solid	ug/Kg	10.0	200.	90	112	30		
3-Nitrotoluene	Solid	ug/Kg	11.6	200.	89	115	30		
4-Amino-2,6-Dinitrotoluene	Solid	ug/Kg	85.6	200.	88	119	30		
4-Nitrotoluene	Solid	ug/Kg	30.2	200.	86	114	30		
HMX	Solid	ug/Kg	30.2	200.	86	117	30		
MNX	Solid	ug/Kg	23.0	100.	70	130	30		
Nitrobenzene	Solid	ug/Kg	7.7	100.	90	109	30		
RDX	Solid	ug/Kg	33.3	200.	90	115	30		
Tetryl	Solid	ug/Kg	117.	250.	60	130	30		

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Method Limit Report
04/04/2005

V2

Method Limit Report using report code 8330 Explosives by 8330 (HPLC) (8330)

Test Long Description	TMX	Units	Limits MDL	RL	LCSLL	LCSUL	LCSRPD	SLL	SUL
1,2-Dinitrobenzene (surr)	TCLP Le	ug/L						62	159
1,3-Dinitrobenzene	TCLP Le	ug/L	0.16	0.16	79	115	20		
1,3,5-Trinitrobenzene	TCLP Le	ug/L	0.16	0.16	77	130	20		
2-Amino-4,6-Dinitrotoluene	TCLP Le	ug/L	0.31	0.31	87	117	20		
2-Nitrotoluene	TCLP Le	ug/L	0.31	0.31	77	113	20		
2,4,6-TNT	TCLP Le	ug/L	0.16	0.16	75	145	20		
2,4-Dinitrotoluene	TCLP Le	ug/L	0.31	0.31	77	123	20		
2,6-Dinitrotoluene	TCLP Le	ug/L	0.31	0.31	85	115	20		
3-Nitrotoluene	TCLP Le	ug/L	0.31	0.31	80	112	20		
4-Amino-2,6-Dinitrotoluene	TCLP Le	ug/L	0.31	0.31	87	117	20		
4-Nitrotoluene	TCLP Le	ug/L	0.31	0.31	76	113	20		
HMX	TCLP Le	ug/L	0.31	0.31	82	116	20		
MNX	TCLP Le	ug/L	0.16	0.16	74	117	20		
Nitrobenzene	TCLP Le	ug/L	0.16	0.16	81	106	20		
RDX	TCLP Le	ug/L	0.16	0.16	86	124	20		
Tetryl	TCLP Le	ug/L	0.39	0.39	84	118	20		

Method Limit Report using report code 8330 Explosives by 8330 (HPLC) (8330)

Test Long Description	TMX	Units	Limits MDL	RL	LCSLL	LCSUL	LCSRPD	SLL	SUL
1,2-Dinitrobenzene (surr)	SPLP Le	ug/L						62	159
1,3-Dinitrobenzene	SPLP Le	ug/L	0.16	0.16	79	115	20		
1,3,5-Trinitrobenzene	SPLP Le	ug/L	0.16	0.16	77	130	20		
2-Amino-4,6-Dinitrotoluene	SPLP Le	ug/L	0.31	0.31	87	117	20		
2-Nitrotoluene	SPLP Le	ug/L	0.31	0.31	77	113	20		
2,4,6-TNT	SPLP Le	ug/L	0.16	0.16	75	145	20		
2,4-Dinitrotoluene	SPLP Le	ug/L	0.31	0.31	77	123	20		
2,6-Dinitrotoluene	SPLP Le	ug/L	0.31	0.31	85	115	20		
3-Nitrotoluene	SPLP Le	ug/L	0.31	0.31	80	112	20		
4-Amino-2,6-Dinitrotoluene	SPLP Le	ug/L	0.31	0.31	87	117	20		
4-Nitrotoluene	SPLP Le	ug/L	0.31	0.31	76	113	20		
HMX	SPLP Le	ug/L	0.31	0.31	82	116	20		
MNX	SPLP Le	ug/L	0.16	0.16	74	117	20		
Nitrobenzene	SPLP Le	ug/L	0.16	0.16	81	106	20		
RDX	SPLP Le	ug/L	0.16	0.16	86	124	20		
Tetryl	SPLP Le	ug/L	0.39	0.39	84	118	20		

Method Limit Report using report code 8330 Explosives by 8330 (HPLC) (8330)

Test Long Description	TMX	Units	MDL	RL	LCSLL	LCSUL	LCSRPD	SLL	SUL
			Limits						
1,2-Dinitrobenzene (surr)	Wipe	ug/Wipe						80	121
1,3-Dinitrobenzene	Wipe	ug/Wipe	1.0	1.0	86	112	30		
1,3,5-Trinitrobenzene	Wipe	ug/Wipe	1.0	1.0	82	125	30		
2-Amino-4,6-Dinitrotoluene	Wipe	ug/Wipe	2.0	2.0	90	112	30		
2-Nitrotoluene	Wipe	ug/Wipe	2.0	2.0	88	114	30		
2,4,6-TNT	Wipe	ug/Wipe	1.0	1.0	67	152	30		
2,4-Dinitrotoluene	Wipe	ug/Wipe	1.0	1.0	87	114	30		
2,6-Dinitrotoluene	Wipe	ug/Wipe	2.0	2.0	90	112	30		
3-Nitrotoluene	Wipe	ug/Wipe	2.0	2.0	89	115	30		
4-Amino-2,6-Dinitrotoluene	Wipe	ug/Wipe	2.0	2.0	88	119	30		
4-Nitrotoluene	Wipe	ug/Wipe	2.0	2.0	86	114	30		
HMX	Wipe	ug/Wipe	2.0	2.0	86	117	30		
MNX	Wipe	ug/Wipe	1.0	1.0	70	130	30		
Nitrobenzene	Wipe	ug/Wipe	1.0	1.0	90	109	30		
RDX	Wipe	ug/Wipe	2.0	2.0	90	115	30		
Tetryl	Wipe	ug/Wipe	2.5	2.5	60	130	30		

Attachment 2.

Example: Standards, Working Spike, and Working Surrogate Concentrations

STL CHICAGO
NITROAROMATICS AND NITROAMINES BY HPLC
CALIBRATION STANDARDS (ug/mL)

COMPOUND	LEVEL 1	LEVEL2	LEVEL 3	LEVEL 4	LEVEL 5	LEVEL 6
HMX	0.020	0.050	0.100	0.200	0.400	1.00
RDX	0.020	0.050	0.100	0.200	0.400	1.00
1,3,5-TNB	0.020	0.050	0.100	0.200	0.400	1.00
1,2-DNB	0.020	0.050	0.100	0.200	0.400	1.00
1,3-DNB	0.020	0.050	0.100	0.200	0.400	1.00
TETRYL	0.040	0.100	0.200	0.400	0.800	2.00
NITROBENZENE	0.020	0.050	0.100	0.200	0.400	1.00
2,4,6-TNT	0.020	0.050	0.100	0.200	0.400	1.00
2-AM-4,6-DNT	0.040	0.100	0.200	0.400	0.800	2.00
4-AM-2,6-DNT	0.040	0.100	0.200	0.400	0.800	2.00
2,4-DNT	0.020	0.050	0.100	0.200	0.400	1.00
2,6-DNT	0.040	0.100	0.200	0.400	0.800	2.00
2-Nitrotoluene	0.040	0.100	0.200	0.400	0.800	2.00
3-Nitrotoluene	0.040	0.100	0.200	0.400	0.800	2.00
4-Nitrotoluene	0.040	0.100	0.200	0.400	0.800	2.00
MNX	0.020	0.050	0.099	0.198	0.396	0.99
PETN*	0.040	0.100	0.200	0.400	0.800	2.00
Nitroglycerine*	0.040	0.100	0.200	0.400	0.800	2.00

*Compounds are not part of routine 8330 list and would require a separate analytical run to report

SPIKE CONCENTRATIONS:

HMX	2.0 ug/mL
RDX	2.0
1,3,5-TNB	2.0
1,3-DNB	2.0
TETRYL	4.0
NITROBENZENE	2.0
2,4,6-TNT	2.0
2-AM-4,6-DNT	2.0
4-AM-2,6-DNT	4.0
2,4-DNT	2.0
2,6-DNT	4.0
2-NITROTOLUENE	4.0
3-NITROTOLUENE	4.0
4-NITROTOLUENE	4.0
MNX	5.0
Petn	1.0
Nitroglycerin	1.0

SURROGATE:

1,2-DNB	2.0 ug/mL

Attachment 3.

STL Corporate Procedure, P-T-001, 'Selection of Calibration Points'

Approvals and Signatures

Senior Vice President & Chief Operating Officer:	Dr. Keith C. Wheatstone	Date: 10/6/2004
Vice President, Client and Operations Services:	Dr. Charles W. Carter	Date: 10/6/2004
Technology Director:	Dr. Richard Burrows	Date: 9/8/2004

1.0 PURPOSE

This policy describes Severn Trent Laboratories (STL) requirements for determination of the number of points, and removal of points from calibration curves.

2.0 SCOPE

Applies to all multi-level initial calibrations.

3.0 POLICY

3.1 If the number of data points required for an initial calibration is defined in the method, Quality Assurance (QA) plan, published report, or previously approved Standard Operating Procedure (SOP) that is what will be used.

3.2 In the cases not defined in Section 1, the number of data points will be determined by the technical director based on the Data Quality Objectives (DQOs) for precision and accuracy to be met by the method.

Examples:

A. Need to analyze a new pesticide in water and a published method does not exist. The data will be used to screen samples by UV-HPLC at a waste site for further remediation, using DQOs that require precision/accuracy of ± 50%.

The Technical director selects 2 data points to represent the range of the expected concentration of pesticide and based on 4 Laboratory Control Samples (LCS), the recoveries ranged from 78-104%. Therefore, 2 data points are sufficient for initial calibration for this method.

NOTE: Calibration curves with less than 3 points should only be used after discussion with the client that the data quality objectives will be met.

B. Same compound as above but being measured in laboratory for meeting regulatory limit of 0.05 mg/L in water. Precision and accuracy of ± 20% required.

A five-point calibration is used, based on similar requirements in published methods with similar objectives and the high level of precision and accuracy required.

As noted above for methods where technical director selects the number of data points to meet DQOs for precision and accuracy, the 4 LCS used in the demonstration of capability will be used to assure those DQOs are met. The SOP will then be approved by the Quality Assurance (QA) Manager.

3.3 Removal of Points from a Calibration Curve

3.3.1 Removal or replacement of levels from the middle of a calibration (i.e., levels other than the highest or lowest) is not permitted unless an injection or instrument problem confined to that point can be clearly documented as described below. Removal of points for individual analytes from levels other than the highest and lowest is not permitted in any event.

3.3.2 If the analyst can document that a level is not valid because of an injection or instrument problem confined to that run, the level may be excluded if the curve still has sufficient levels, or the run may be repeated once only. The whole level (all compounds) must be removed or replaced. The curve is evaluated with the level removed or replaced. If the curve still fails to meet criteria, then corrective action must be taken and the whole curve reanalyzed. Corrective action may include, but is not limited to, instrument maintenance and/or re-preparation of standards.

3.3.3 One of the following conditions must be satisfied to allow removal or replacement of a level:

- The data file is corrupted and unusable or the run is interrupted before completion.
- The analyst observes and documents a problem such as leaking of a purge vessel.
- For internal standard methods, the recovery of the internal standards is less than 70% or greater than 130% of the recovery in the other standards, or the amount of analyte recovered is less than 70% or greater than 130% of the expected values (indicating an improperly made up standard).
- For external standard methods, the unit response of the analyte is less than 70% or greater than 130% of the average unit response for the analyte in the other calibration standards (indicating an improperly prepared standard or bad injection).

3.3.4 When using autosamplers with discrete sample pathways for different samples (such as 16 port purge and trap autosamplers) the level to be replaced must be reanalyzed on the same port or that port must be excluded from sample analysis until corrective action is performed and verified by successful analysis of a continuing calibration standard on that port.

3.3.5 The reason for replacing the level **must** be documented in the run log. The fact that the curve passes criteria with the level removed is **not** alone sufficient evidence to document an injection or instrument problem confined to the level.

3.3.6 Removal of the highest or lowest levels is permitted, but the calibration range must be adjusted accordingly. If the lowest level is removed then the reporting limit is raised to be equivalent to the lowest level used in the calibration curve. In any event the number of levels remaining in the calibration must be at least that required by the method.

3.3.7 Removal of the highest or lowest point is permitted on a compound specific basis. This may be necessary when strongly responding and poorly responding analytes are included in the same standard mix at the same level. Each compound must have at least the minimum number of calibration levels required by the method.

4.0 RESPONSIBILITIES

All STL associates utilizing methods involving multi-point calibrations are required to follow this policy.

5.0 ATTACHMENTS

Not Applicable.

6.0 REVISION HISTORY

Revision 3: Updated by Richard Burrows, Technology Director; 9/8/2004.
Section 3.2: Amended 'NOTE'.
Section 3.3.3, bullet #4, text reworded for clarification.

Attachment 4.

Example: Analysis Run Log / Maintenance Log

Extraction Date:__________
Solvent:__________

STL Chicago
Explosives Extraction Record

Page No.:__________
Analyst Initials:__________

LabNet Batch No.:__________

Matrix: a. Water b. Soil
c. Other:__________

Extraction Method: SW-846 8330 / 8332

	STL #	Sample ID	ICOC	Initial Volume (mLs) / Weight (g)	Final Volume (mLs)	Multipliers		
						Surr.	Spike	Split
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

Note: Soil samples are dried prior to the taking of a sample aliquot for extracting.

Comments:__________

Surrogate:__________ Volume:__________ Std. ID#:__________
LCS/MS Solution:__________ Volume:__________ Std. ID#:__________
LCS/MS Solution:__________ Volume:__________ Std. ID#:__________

Analyst Signature:__________ Date:__________

Reviewer Signature:__________ Date:__________

Analysis Custody Record

Sample(s)	Date/Time Out	Date/Time In	Analyst	Sample(s)	Date/Time Out	Date/Time In	Analyst

Instrument No. 45/46

STL Chicago
HPLC Analysis Log

Page No.:____________

Analyst:____________ Method:____________ Column:____________

Queue:____________ Inj. Vol.:____________ Flow:____________ Column Temp.:____________

Mobile Phase:____________ Barr:____________ Wavelength:____________

Rep. #	Sample Description	Dil. Factor	Injection Date/Time	Comments

Reviewer:____________ Date:____________

CHI-22-18-020/B-08/03

STL Chicago
HPLC Instrument Maintenance Log

Page No.:______________
Instrument No.: 45/46

Routine/Informal Maintenance includes: Periodically check all pump seals for leaks.

Entry No.:__________

Date of Maintenance:__________________ Analyst:________________________

___ Changed Purge Valve Frit
___ Changed Pre-Column Filter
___ Flushed Column with __________
___ Changed Lamp
___ Changed Column
___ Repair / Replaced Pump Seal(s)
___ Other (explain)

Explain/Actions Taken:____

Demonstration of Control:
___ CCV analyzed and in-control.
___ Samples Reanalyzed.
___ Other (explain)

Explain:____

Entry No.:__________

Date of Maintenance:__________________ Analyst:________________________

___ Changed Purge Valve Frit
___ Changed Pre-Column Filter
___ Flushed Column with __________
___ Changed Lamp
___ Changed Column
___ Repair / Replaced Pump Seal(s)
___ Other (explain)

Explain/Actions Taken:____

Demonstration of Control:
___ CCV analyzed and in-control.
___ Samples Reanalyzed.
___ Other (explain)

Explain:____

Reviewer Signature:______________________________ Date:______________

Attachment 5.

Example: Data Review Checklist

STL Chicago
EGC / HPLC / GC VOA DATA REVIEW CHECKLIST

Site Name:____________________ Primary Reviewer:___________________________ Review Date:______________
JOB Number:____________________ Secondary Reviewer:__________________________ Review Date:______________
No. of Samples/Matrix: a)____ WATER b)_____ SOIL c)_____ TCLP / SPLP d)_____ Other (___________)
Review Level: a) Full b) Cursory Method: a) GC VOA _______ b) GC _______ c) HPLC _______ d) Other (________)
Extr. Method: a) SW 3510 b) SW 3520 c) SW 3550 d) SW 3580 e) SW 3541 f) SW 5030 /5035 g) CLP____ h) Other (________)

CAR's _______ Std. Traceability _______ TASK	PRI REV	SEC REV	COMMENTS
LAB CHRON: 1) Matches Raw Data (Form 4, 8)			
2) Samples which were Re-Analyzed or Re-Extracted were Re-Logged into LabNet			
3) Sample Hold Times were Met			
4) Proper Prep Links were created			
PROJ. REQ.MET: 1) List of Compounds			
2) Sample Detection Limits Met			
3) Method Blank Detection Limits Met			
LabNet Batch Status Report Displays Data at RVWD Status Incomplete JOB Status Report reveals no Outstanding Data			
FORM 1: 1) Matches Quant Report			
2) Matches LabNet Report			
FORM 2: Surrogate Recoveries Within Limits Statistical Limits ______ Method Limits ______ Project Limits ______(S-F10 used to Clone By Project)			
FORM 3: MS/MSD Recoveries Acceptable Statistical Limits ______ Method Limits ______ Project Limits ______(S-F10 used to Clone By Project)			
FORM 3: BS Recoveries Acceptable Statistical Limits ______ Method Limits ______ Project Limits ______(S-F10 used to Clone By Project)			
Initial Calibration Criteria Met			
Daily Calibration (CCV) Criteria Met			
Form 10: 1) Retention Window (RT) Criteria Met			
2) Concentrations Correct			
Correct Usage of FLAGS			
RAW DATA: 1) Raw Data Verified/Complete			
2) Raw Data Matches Forms			
NARRATIVE: 1) Holding Times			
2) Method References			
3) % Recoveries / RPD's			
4) Analytical Difficulties/Typos			

COMMENTS:

REVIEW CYCLE	REASON
1	
2	
3	
4	

STL Chicago
GC/HPLC Data Review Checklist - "CLP-like"
(SW-846 and 40 CFR)

Client: ______________________ **JOB#:** __________________ **Test:**

Reviewer(1): ______________________________________ **Date:**

Reviewer(2): ______________________________________ **Date:**

COC/Deliverable

Reviewer 1 | Reviewer 2

____ ____ Chain-of-custody has been checked to ensure that the proper analyte list is reported.
____ ____ All special project requirements are met, i.e., control limits, forms, etc...

Comments: ____

Updating Results in Labnet

____ ____ Reagent codes are correct.
____ ____ Batch test results match quant. reports.
____ ____ Batch cloned for project limits.
____ ____ Proper prep links were created (including TCLP link).
____ ____ Each required target compound displays "0" when data is reported.
____ ____ Client information has been checked for correct list, reporting limits, special requirements.
____ ____ Job Notes (CTRL F12) for the job have been reviewed.

Form 1/Associated Data

____ ____ Observe chromatograms, check for obvious chromatography errors.
____ ____ Check form information for correctness (JOB #, reporting limit, dilution factor, matrix, flags, etc....)
____ ____ Check values reported. In an "E" is present, there must be another dilution; if a value is reported, review the chromatogram; if a "J" is reported, review the chromatogram; if an "I" is reported, there must be another dilution run.
____ ____ Check that all JOB #'s on the chromatograms match quant report and data on quant report is correct.
Check that confirmation chromatograms agree with quantitation chromatograms.
____ ____ All method blanks are clean.
____ ____ All OPC file information is present and correct (matrix, final volume, %sol present for soils).
____ ____ Before and after chromatograms are present for all Manual integrations and are dated/initialed by analyst.

Comments: ____

Form 2/Associated Data

____ ____ Requested surrogates were used.
____ ____ All surrogate recoveries are within control limits. If not, proper corrective actions have been taken and are documented. [Samples with surrogates outside of control limits may not require re-analysis but must be evaluated, flagged, and discussed in the case narrative. If not specified by the client, both (if applicable) surrogate recoveries must be within statistical control limits. Surrogates associated with the method blank and blank spikes should be within control.]
____ ____ Confirm all samples and QC for that batch are represented.
____ ____ Confirm correct matrix.
____ ____ Correct surrogate concentration used for calculating % Recovery. Verify calculations.

Comments: ____

Form 3/Associated Data

Reviewer 1	Reviewer 2	
____	____	Blank spike and blank spike duplicate have the proper batch number, and the proper matrix
____	____	All blank spike/blank spike duplicate recoveries and RPDs are within control limits. If not, proper corrective actions have been taken and documented. Flag outliers for the Case Narrative and provide documentation.
____	____	Confirm that the matrix spike and matrix spike duplicate data correlates with the unspiked analysis.
____	____	All matrix spike/matrix spike duplicate recoveries and RPDs are within control limits. If not, proper corrective actions have been taken and documented. Flag outliers for the Case Narrative.
____	____	Confirm correct matrix and sample ID.
____	____	Correct spike concentration used for calculating % Recovery. Verify calculations.

Comments:____

Form 4/Associated Data

____	____	Check all header information, extraction date, analysis date and time, instrument and column IDs.
____	____	Confirm all samples associated with the blank are present.
____	____	Confirm all blank summaries are present for all samples/matrices in the data package.
____	____	Confirm proper matrix and extraction method.
____	____	Sulfur cleanup performed (not applicable to some methods)

Comments:____

Endrin/DDT Breakdown

____	____	All breakdown criteria is met (<15% for DDT and/or Endrin) for 608 and 8081A only.

Comments:____

Initial Calibration/Associated Data (Form 6)

____	____	Method SW-846: All % RSDs are <20% (5-pt. minimum)
____	____	Method 40CFR: All %RSDs are <10% (3-pt. minimum).
____	____	Recalculate a few %RSDs.
____	____	All header information is correct (times, dates).
____	____	Second Source Verification (SSV) is in control (85%-115%)

Comments:____

Continuing Calibration Verification/Associated Data (Form 7) - **Standards that are outside the control limits must be approved by the Section Manager prior to the reporting of any data.**

____	____	All header information is correct. Dates and times of initial standards and continuing standards are correct.
____	____	All retention times are within their windows, those that are outside are marked for Case Narrative.
____	____	Ave. CFs match from ICAL (Form 6) Ave CFs.
____	____	All %Ds are within control limits. If not, proper corrective actions have been taken and documented.
____	____	All Form 7's associated with the samples and QC are present.

Comments:____

Form 10/Associated Data

Reviewer 1	Reviewer 2	
____	____	Confirm that all analytes which are reported as being detected on the Form 1 are present.
____	____	Confirm that all retention times of analytes reported as positive hits are within their retention time window, and if they aren't, why the analyst reported them must be documented in the comment section.
____	____	The GC columns are marked Y/N for quantitation/confirmation (applicable to 8330 only).

Comments:____

Additional Data

____	____	All necessary runlogs are present and contain the proper sequences.
____	____	All necessary extraction records are present.
____	____	All required holding times were met for samples dilutions and QC.
____	____	Chronology of data is correct.
____	____	Dates and times of analysis are correct.
____	____	Verify samples are quantitated using the proper ICAL.

Comments:____

____ RG LabChron/Report Review Initial/Date ______________

Project: ______________________ **Job #:**____________ **Method:**__________

Reviewer (1):______________________________________ **Date:**__________

Reviewer (2):______________________________________ **Date:**__________

Sublist:______________
Instruments (Primary/Confirmation):__________
Cleanups:______________________
CAR (Y/N):_____________________

Target Review

Reviewer 1	Reviewer 2	
____	____	Chromatography is acceptable.
____	____	Chromatograms are scaled properly.
____	____	All peaks are labeled properly.
____	____	All initial calibrations are within control limits ($\leq$ 20% RSD; Correlation Coefficient $\leq$ 0.995).
____	____	Second Source Verification is in control (85% - 115%).
____	____	All continuing calibrations are within control limits ($\pm$ 15% difference).
____	____	All retention times are within their windows.
____	____	All method blanks are clean.
____	____	Calculations verified.
____	____	Verify samples are quantified using the proper ICAL.
____	____	Before and after chromatograms produced for all manual integrations.

Comments:____

Updating Results in LabNet

____	____	Reagent codes are correct.
____	____	Batch test results match quant reports.
____	____	Batch cloned for project limits.
____	____	Proper prep links were created (including TCLP link).
____	____	Each required target compound diplays "0" when data is reported.
____	____	Client information has been checked for correct list, reporting limits, special requirements.
____	____	Job notes (CTRL F12) for the job have been reviewed.

Comments:____

GC/HPLC Data Review Checklist

QC Data

____ ____ All LCS/LCD recoveries (and RPDs) are within the required control limits (verify calc.).
____ ____ All surrogate recoveries are within the required control limits (verify calc).
____ ____ All MS/MSD recoveries and RPDs are within the required control limits (verify calc.).

Comments:____________________

Note: Anything out of the ordinary must be commented on and be approved by the Unit Leader/Section Manager for inclusion in the Case Narrative.

____ RG LabChron/Report Review Initial/Date ____________

Comments:

Attatchment 6.

Solid Phase Extraction (SPE) Method 3535

EPA Method 3535
Explosives from aqueous samples

I. Materials

Strata SPE: SDBL 500 mg/ 6mL
Part Number: 8B-S014-HCH
Conditioning Solvent: Methylene Chloride (DCM), Acetonitrile, DI Water
Wash Solvent: DI Water
Extraction Solvent: Acetonitrile

II. Solid Phase Extraction Method

A. Condition: Slowly pass through the cartridge (3-6ml /min)

1. Rinse with DCM (about 18mL) with no vacuum.
2. 1 column volume of Acetonitrile (about 6mL)
3. 1 column volume of DI water (about 6mL)

B. Load Sample:

For processing large volume samples greater than 6mL; refer to Phenomenex Strata publication entitled "*Processing Large Volume Samples with Strata SPE Cartridges*" located on next page.

C. Wash:

Wash the sample with three column volumes (about 18mL) of DI Water. Dry thoroughly for 30-60 seconds to insure removal of aqueous wash.

D. Elute: (about 2 minutes)

1. Rinse the sample bottle with 5mL of Acetonitrile:MeOH 80:20 and decant into the syringe barrel reservoir.
2. Engage vacuum until the Acetonitrile just begins to drip through the sorbent, then stop and allow remaining volume of Acetonitrile to drain through by gravity into the collection tube. Apply vacuum to get the final drops.

See Section 7.3.1.10 for preparation of sample for analysis.

Processing Large Volume Samples with Strata SPE Cartridges

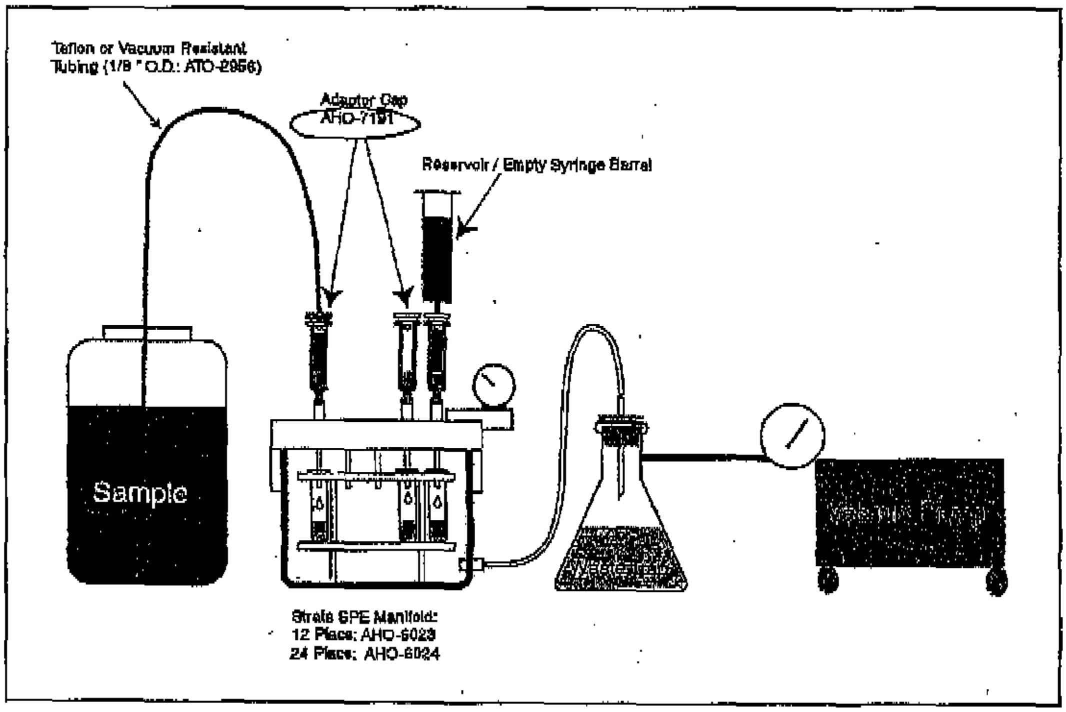
A major benefit of SPE is its ability to concentrate trace amounts of analyte from very dilute, large volume samples. Unfortunately these samples are often several times larger than the reservoir capacity of the SPE cartridge. Several strategies have proven most useful in dealing with these large volume samples.

1. Apply the sample to the cartridge in multiple aliquots.

2. Attach a separate, large-volume reservoir to the top of the SPE cartridge using an adapter cap.

3. Connect the SPE cartridge directly to the sample reservoir using a piece of tubing. The applied vacuum creates a suction that draws the sample from the sample reservoir through the tubing, into the SPE cartridge and through the sorbent bed. Vacuum tight connection between the tubing and the SPE cartridge adapter is critical.

Reminder: A cartridges' retention capacity is strictly related to the mass of sorbent packed into the cartridge and is unaffected by the so-called "reservoir" volume capacity of the cartridge. For example, a 500 mg / 3 ml tube has the exact same retention capacity as a 500 mg / 6 ml, or a 500 mg / 12 ml.



SOP No.	Revision No.	Date	Page
UME-245.1	10	03/25/05	1 of 26

TITLE: **Metals Analysis**
Mercury by EPA Methods 245.1/245.5; SW-846 7470A/7471A; and U.S. EPA CLP Document No. ILM04.0

Updated by:	Signature:	Date:
George O. Klee Senior Analyst, Mercury	George O. Klee	3/22/05

Approved by:	Signature:	Date:
Jodi L. Gromala Section Manager, Metals Dept.	Jodi L. Gromala	3/22/05
David W. Mazur Env. Health & Safety Coor.	D. W. Mazur	3/22/05
Terese A. Preston Quality Manager	Terese A. Preston	3/22/05

CONTROLLED DISTRIBUTION

COPY # :

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ISSUED TO :

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

1.0 SCOPE / APPLICATION

This Standard Operating Procedure (SOP) outlines the digestion and analytical procedure for the determination of the mercury concentration in aqueous and non-aqueous media. This SOP was written using EPA 600/4-79-020 Methods 245.1 and 245.5; SW-846, 3rd Edition, Methods 7470A/7471A; and U.S. EPA CLP Document No. ILM04.0 as references.

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP), authorized via laboratory signature approval, and mentioned in the data package's case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

1.1.2 Instrument Detection Limits

Instrument Detection Limits (IDLs) are performed quarterly for each element by the metals laboratory for each instrument as specified in CLP. These limits are used to gauge instrument sensitivity and when routinely evaluated, instrument performance without the introduction of method variance can be determined.

1.1.3 Reporting Limits

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. The laboratory maintains reporting limits that are higher than the MDL. Wherever possible, reporting is limited to values approximately 3-5x the respective MDL to ensure confidence in the value reported. Client specific requests for reporting to the IDL or MDL are special circumstances not to be confused with the previous statement.

Matrix	Reporting Limit [1]	CRDL [2]
Water	0.2 ug/L	0.2 ug/L
Soil	0.017 mg/kg	0.1 mg/kg

[1] Reporting Limit is used for EPA Method 245.1 and SW-846 7470A/7471A. Reporting Limits may vary depending on sample volume/size, dilution factors, and changes in the MDL.
[2] CRDL (Contract Required Detection Limit) is used for U.S. EPA CLP ILM04.0.

1.1.4 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM, Revision 03).

1.2 Summary of Method

This flameless cold vapor AA procedure is a physical method based on the absorption of radiation at 253.7 nm by mercury vapor. The mercury is reduced to the elemental state and swept from solution and passed through a cell of a double beam AA. Absorbance is a function of mercury concentration.

2.0 INTERFERENCES

- Chloride, sulfide and certain volatile organic materials.

3.0 SAFETY

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

3.1 Specific Safety Concerns or Requirements

- Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

3.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method.** The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Mercury (1,000 ppm in Reagent)	Oxidizer Corrosive Poison	0.1 Mg/M3 Ceiling (Mercury Compounds)	Extremely toxic. Causes irritation to the respiratory tract. Causes irritation. Symptoms include redness and pain. May cause burns. May cause sensitization. Can be absorbed through the skin with symptoms to parallel ingestion. May affect the central nervous system. Causes irritation and burns to eyes. Symptoms include redness, pain, and blurred vision; may cause serious and permanent eye damage.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison	1 Mg/M3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Hydrochloric Acid	Corrosive Poison	5 ppm-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Potassium Permanganate	Oxidizer	5 Mg/M3 for Mn Cmpds.	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Dry crystals and concentrated solutions are caustic causing redness, pain, severe burns, brown stains in the contact area and possible hardening of outer skin layer. Diluted solutions are only mildly irritating to the skin. Eye contact with crystals (dusts) and concentrated solutions causes severe irritation, redness, and blurred vision and can cause severe damage, possibly permanent.
Potassium Persulfate	Oxidizer	None	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Causes irritation to skin and eyes. Symptoms include redness, itching, and pain. May cause dermatitis, burns, and moderate skin necrosis.

1 – Always add acid to water to prevent violent reactions.
2 – Exposure limit refers to the OSHA regulatory exposure limit.

4.0 EQUIPMENT AND SUPPLIES

- 2 – Leeman Labs Model PS200 Automated Mercury Analyzer
- Class A volumetric glassware
- Eppendorf pipettes

5.0 REAGENTS AND STANDARDS

5.1 Reagents

5.1.1 Miscellaneous Reagents

- Hydrochloric Acid [HCl], Concentrated
- Nitric Acid [HNO_3], Concentrated
- Sulfuric Acid [H_2SO_4], Concentrated
- Deionized (DI) Water, Type II

5.1.2 Sodium Chloride-Hydroxylamine Hydrochloride Solution

Dissolve 240 g of sodium chloride and 240 g of hydroxylamine hydrochloride in sufficient DI water to make 2-liters of solution.

- Life of Reagent: 1 Year
- Storage Requirements: None

5.1.3 Stannous Chloride Solution

Dissolve 100 g of stannous chloride in 10% hydrochloric acid to make 1-liter of solution.

- Life of Reagent: 1 Month
- Storage Requirements: None

5.1.4 Potassium Permanganate, 5%

Dissolve 175 g of potassium permanganate into 3.5-liters of DI water.

- Life of Reagent: 1 Year
- Storage Requirements: None

5.1.5 Potassium Persulfate, 5%

Dissolve 175 g of potassium persulfate into 3,500 mLs of DI water.

- Life of Reagent: 1 Year
- Storage Requirements: None

5.2 Standards All standards are prepared in Class A volumetric flasks.

5.2.1 Standard Stock Solution I; 1,000 ppm

A 1,000 ppm concentrated mercury standard is purchased from an outside supplier.

- Life of Standard: 1 Year
- Storage Requirements: None

5.2.2 Working Standard Solution I; 100 ppb

To a 1.0 L volumetric flask filled with ~800 mLs DI water, transfer 100 uLs of Stock Solution I to the flask using a 100 uL Eppendorf pipette. Add 2.5 mLs conc. nitric acid as a preservative. Dilute to volume with DI Water. Invert and mix to insure complete mixture.

*For use in spiking Matrix Spikes, CRAs & the Standard Curve.

- Life of Standard: 24 Hours
- Storage Requirements: None

5.2.2.1 Working Standard Solution IA; 25 ppb

To a 100 mL volumetric flask filled with ~80 mLs DI water, transfer 25 uLs of Working Standard Solution I (Item 5.2.2) to the flask using an Eppendorf pipette. Dilute to volume with DI Water. Invert and mix to insure complete mixture.

*For use in spiking Matrix Spikes, CRAs & the Standard Curve in the **Hot Block Digester**

- Life of Standard: 24 Hours
- Storage Requirements: None

5.2.3 Standard Stock Solution II; 1,000 ppm

Purchased from an outside supplier as a 1,000 ppm solution and is from an alternate source than that of Standard Stock Solution I (Rgt. 5.2.1).

- Life of Standard: 1 Year
- Storage Requirements: None

5.2.4 Working Standard Solution II; 200 ppb

To a 1.0 L volumetric flask filled with ~800 mLs DI water, add 2.5 mLs concentrated nitric acid (as a preservative) and 200 uLs of Standard Stock Solution II to the flask (using a 200 uL Eppendorf pipette). Dilute to volume with DI water and invert several times to mix.
*For use in spiking the ICV/CCV and LCS.

- Life of Standard: 24 Hours
- Storage Requirements: None

5.2.4.1 Working Standard Solution IIA; 50 ppb

To a 100 mL volumetric flask filled with ~80 mLs DI water, add 25 uLs of Working Standard Solution II (Item 5.2.4) to the flask using an Eppendorf pipette. Dilute to volume with DI Water. Invert and mix to insure complete mixture.

*For use in spiking the ICV/CCV and LCS in the **Hot Block Digester**

- Life of Standard: 24 Hours
- Storage Requirements: None

5.2.5 Working Standards for Mercury in Water

Standard (ug/L)	mLs of Working Soln. I or IA	Final Volume (mLs) Water Bath	Final Volume (mLs) Hot Block
Blank	0.0	100	25
0.2	0.2	100	25
0.5	0.5	100	25
1.0	1.0	100	25
3.0	3.0	100	25
5.0	5.0	100	25
CRA (0.2 ug/L)	0.2	100	25
Matrix Spike (1.0 ug/L)	1.0	100	25

Standard (ug/L)	mLs of Working Soln. II or IIA	Final Volume (mLs) Water Bath	Final Volume (mLs) Hot Block
Init. Cal. Verif. (ICV) (2.0 ug/L)	1.0	100	25
Cont. Cal. Verif. (CCV) (1.0 ug/L)	0.5	100	25
Lab Control Sample (LCS) (2.0 ug/L)	1.0	100	25

CLP Standard (ug/L)	mLs of Working Soln. II or IIA	Final Volume (mLs) Water Bath	Final Volume (mLs) Hot Block
Init. Cal. Verif (ICV) (2.0 ug/L)	1.0	100	25
Cont. Cal. Verif. (CCV) (1.0 ug/L)	0.5	100	25

NOTE: ILM04.0 requires the ICV and CCV to be at different levels.

5.2.6 Working Standards for Mercury in Soil (Block Digestion)

Standard (ug/L)	mLs of Working Soln. I	Final Volume (mLs) Hot Block
Blank	0.00	50
0.2	0.10	50
0.5	0.25	50
1.0	0.50	50
3.0	1.50	50
5.0	2.50	50
CRA (0.2 ug/L)	0.10	50
Matrix Spike (1.0 ug/L)	0.50	50

Standard (ug/L)	mLs of Working Soln. II	Final Volume (mLs) Hot Block
Init. Cal. Verif. (ICV) (2.0 ug/L)	0.50	50
Cont. Cal. Verif. (CCV) (1.0 ug/L)	0.25	50
Lab Control Sample (LCS) (2.0 ug/L)	0.50	50

CLP Standard (ug/L)	mLs of Working Soln. II	Final Volume (mLs) Hot Block
Init. Cal. Verif (ICV) (2.0 ug/L)	0.50	50
Cont. Cal. Verif. (CCV) (1.0 ug/L)	0.25	50

NOTE: ILM04.0 requires the ICV and CCV to be at different levels.

6.0 CALIBRATION (NON-DAILY)

All calibration procedures are performed on a daily basis. Refer to Section 7.4 for details.

7.0 PROCEDURE

7.1 Quality Control Checks

The following Quality Control samples are performed with each batch of samples. Refer to Section 8.0 for additional details.

QC Sample	Frequency [1]	Control Limits
Method Blank (MB)	1 in 20 samples	• < Reporting Limit (EPA / SW-846) • < CRDL (CLP)
LCS	1 in 20 samples	• 80-120% Recovery (EPA 245.5 / SW-846 / CLP) • 85-115% Recovery (EPA 245.1)
Matrix Duplicate (MD)[2]	1 in 20 samples	• 20 RPD unless the sample conc. is <5x RL, then ± RL. (EPA / SW-846) • 20 RPD unless the sample conc. is <5x CRDL, then ± CRDL. (CLP)
Matrix Spike (MS) MS Duplicate (MSD)[2]	1 in 20 samples	• 75 – 125% Recovery unless the sample concentration > spike level by 4x (EPA 245.5 / SW-846 / CLP) • 70 – 130% Recovery (EPA 245.1) • > 50% Recovery; if <50% Recovery, Method of Standard Additions (MSA) is required (TCLP)

[1] Drinking waters by EPA 245.1; and CLP analyses are analyzed at a frequency of 1 in 10 samples.
[2] The sample selection for MS/MSD or MS/MD, where appropriate, are rotated among client samples so that various matrix problems may be noted and/or addressed. MD's are performed only when requested by the client/project/contract. The MS/MSD are the routinely performed matrix QC indicators.

7.2 Sample Preservation and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client request. Listed below are the holding times and preservations for the referenced programs.

Program	Preservation [1]	Holding Time [2]
SDWA	pH < 2, Cool 4 ± 2°C	28 days VTS [3]
CWA	pH < 2, Cool 4 ± 2°C	28 days VTS
RCRA	pH < 2, Cool 4 ± 2°C	28 days VTS
CLP	pH < 2, Cool 4 ± 2°C	26 days VTSR [4]

[1] Waters are preserved with nitric acid at pH <2; Soils are preserved at Cool 4 ± 2°C.
[2] Holding times include digestion and analysis.
[3] VTS: Verified Time of Sampling.
[4] VTSR: Verified Time of Sample Receipt.

7.3 Sample Preparation

7.3.1 Mercury Water Digestion Procedure - EPA Method 245.1 / CLP ILM04.0

Item	Full Scale (Water Bath)	Hot Block
Sample Volume	100 mLs	25 mLs
Reaction Vessel	BOD Bottle, 300 mLs	Sample Vials, 50 mLs
Sulfuric Acid (conc.)	5 mLs	1.25 mLs
Nitric Acid (conc.)	2.5 mLs	0.625 mLs
Potassium Permanganate, 5% Sol. (W/V)	15 mLs	3.75 mLs
Potassium Persulfate, 5% Sol. (W/V)	8 mLs	2 mLs
Preparation	2 hrs. @ 90 – 95°C, Cool	2 hrs. @ 90 - 95°C, Cool
Hydroxylamine Addition	6 mLs	1.5 mLs
Total Volume	136.5 mLs	34.125 mLs

NOTE: The sample should remain purple for 15 minutes after adding the potassium permanganate. It the sample does not maintain the purple color, a second addition of potassium permanganate is added to all samples of the batch to maintain the purple color.

Proceed with the Stannous Chloride addition.

7.3.2 Mercury Water Digestion Procedure - SW-846 Method 7470A

Item	Full Scale (Water Bath)	Hot Block
Sample Volume	100 mLs	25 mLs
Reaction Vessel	BOD Bottle, 300 mLs	Sample Vials, 50 mLs
Sulfuric Acid (conc.)	5 mLs	1.25 mLs
Nitric Acid (conc.)	2.5 mLs	0.625 mLs
Potassium Permanganate, 5% Sol. (W/V)	15 mLs	3.75 mLs
Potassium Persulfate, 5% Sol. (W/V)	8 mLs	2 mLs
Preparation	2 hrs. @ 90-95°C, Cool	2 hrs. @ 90 - 95°C, Cool
Hydroxylamine Addition	6 mLs	1.5 mLs
Total Volume	136.5 mLs	34.125 mLs

NOTE: The sample should remain purple for 15 minutes after adding the potassium permanganate. It the sample does not maintain the purple color, a second addition of potassium permanganate is added to all samples of the batch to maintain the purple color.

Proceed with the Stannous Chloride addition.

7.3.3 Mercury Soil Digestion Procedure - SW-846 Method 7471A

NOTE: Three aliquots of soils (~0.2 g) are combined and digested as one sample.

Item	Full Scale (Water Bath)	Hot Block
Sample Weight	~ 0.6 – 0.7 grams	~ 0.6 – 0.7 grams
Reaction Vessel	BOD Bottle, 300 mLs	Digestion Vessel
DI Water, Type II	5 mLs	2.5 mLs
Aqua Regia [3:1 HCl (conc.) to HNO_3 conc.)]	5 mLs	2.5 mLs
Preparation	2 min. @ 90-95°C, Cool	2 min. @ 90-95°C, Cool
DI Water, Type II	50 mLs	25 mLs
Potassium Permanganate, 5% Sol. (W/V)	15 mLs	7.5 mLs
Preparation	30 min. @90-95°C, Cool	30 min. @90-95°C, Cool
Hydroxylamine Addition	6 mLs	3 mLs
Total Volume	Dilute to 100 mLs	50 mLs

NOTE: The sample should remain purple for 15 minutes after adding the potassium permanganate. It the sample does not maintain the purple color, a second addition of potassium permanganate is added to all samples of the batch to maintain the purple color.

Proceed with the Stannous Chloride addition.

7.3.4 Mercury Soil Digestion Procedure - EPA Method 245.5 / CLP ILM04.0

Item	Full Scale (Water Bath)
Sample weight	0.2 - 0.3 grams
Reaction Vessel	BOD bottle, 300 mLs
Sulfuric Acid (conc.)	5 mLs
Nitric Acid (conc.)	2.5 mLs
Preparation	2 min. @ 90 -95°C, Cool
DI Water, Type II	50 mLs
Potassium Permanganate, 5% Sol. (W/V)	15 mLs
Potassium Persulfate, 5% Sol. (W/V)	8 mLs
Preparation	30 min. @ 90 - 95°, Cool
Hydroxylamine Addition	6 mLs
Total Volume	Dilute to 100 mLs

NOTE: The sample should remain purple for 15 minutes after adding the potassium permanganate. It the sample does not maintain the purple color, a second addition of potassium permanganate is added to all samples of the batch to maintain the purple color.

Proceed with the Stannous Chloride addition.

7.4 Calibration / Standardization

Before the instrument is used as a measurement device, the instrument response to known reference materials must be determined. All sample measurements must be made within this linear range of the instrument.

Standard	Frequency	Control Limit
Calibration Curve	Initially	Corr. Coeff. ≥ 0.995
ICV	After the Calibration Curve	• 90 –110% Recovery (EPA 245.5 / SW-846 / CLP) • 95 – 105% Recovery (EPA 245.1)
ICB	After the ICV	• < Reporting Limit (EPA / SW-846) • < CRDL (CLP)
CRA	After ICB	• No established limits.
CCV	Every 10 readings; end of each run	• 90 – 110% Recovery (EPA / CLP) • 80 – 120% Recovery (SW-846) (Note: The LabNet (LIMS) QC criteria code for the CCV is set at the default limit of 90-110% for all methods.)
CCB	Every 10 readings; End of each run	• < Reporting Limit (EPA / SW-846) • < CRDL (CLP)

7.4.1 Calibrating the System

The instrument must be calibrated before samples are analyzed.

To perform a calibration, go to the WinHg Runner and select the 'STANDARD' tab. Select the standards to be used by clicking on the S1, S2, S3, S4, S5 and S6 buttons. To set the number of replicates, click on the Rep1 button. Click on the 'Stnd Auto' button and the calibration will begin.

Reviewing the Calibration:
Go to the Database application by clicking the 'DB' button on the toolbar. Click on the 'Cal Curve' tab. Calibration data can be accepted by clicking the 'Accept' button.

7.4.2 Check Standards

This option allows for the verification that the calibration has not drifted. The Check Standards are placed in the tray with the samples to allow for AutoRun:

Positions 1-5: ICV, ICB, CRA, MB, LCS
Positions 11-12: CCV, CCB

To check standard concentrations:

- From the Main Menu, select CALIBRATION and then select CHECK STANDARDS. The check standard screen will appear.

- Type 1 for a check standard blank. Enter, in units specified on the standards page, the range of acceptance.
- Type 2 for check standards cup 2. Type the concentration and Enter. Type the percent acceptance and Enter.
- Repeat this for up to seven check standards.
- From Main Menu, select AUTOSAMPLES, then select SETUP and then check Enter the C1 frequency (e.g., 5/EPA protocol)
- Halt: Enter Y if the instrument should halt after an unacceptable check standard. Enter N for an alert only. Macros can be written to automatically recalibrate and rerun samples if check standards fall outside specifications.

7.5 Preventive Maintenance

The instrument requires some routine daily maintenance as well as some scheduled and non-scheduled periodic maintenance. All maintenance will be recorded in the instruments maintenance logbook. The following maintenance schedule lists the various maintenance procedures and when they should be performed. Each of these procedures is described in the following sections.

7.5.1 Maintenance Schedule

Equipment	Schedule
Drying Tube	Must be changed daily.
Pump Tubing	Weekly, or as needed.
Lamp	Replace as needed (avg. 4 mos. - 1 yr.).
Optical Cell	Clean as needed (typically monthly).
Liquid Gas Separator	Replace every 1-3 yrs., as needed.
Internal Tubing	Should not require replacement under normal circumstances.

7.5.2 Packing and Changing the Drying Tube

Under normal use, the drying tube must be changed each morning before analyzing samples. (The drying tube is located on the front panel on the left side of the instrument) Several tubes can be packed at one time and stored in an airtight container for a ready supply.

To pack a tube, plug one end with quartz wool, pour in magnesium perchlorate to fill tube, and plug the other end with quartz wool.

To change a tube, slightly loosen the nuts that hold the tube in at either end and slide the used tube out of the fittings. Slide a fresh tube into the fittings and tighten the fittings with your fingers to make a gas-tight seal.

To clean a tube, remove the quartz wool and the magnesium perchlorate. Either dispose of as a solid waste or dissolve in water and dispose of as a liquid waste. Clean the tube with ordinary laboratory glassware cleaner and dry thoroughly.

7.5.3 Replacing and Conditioning Pump Tubing

Pump Tubing should be replaced weekly or when it shows signs of wear. There are four pump tubes: two for drainage, one for sample, and one for reductant. Each tube is fed through a pump cassette which then clamps onto the pump head. Slide a tube through the plastic clips at the bottom of a cassette until the plastic tab is secure. Hold the tube taut, slide the loaded cassette onto the pump head, and lock the clamp up. Repeat for the remaining tubes, then connect the tubes ends.
For optimal performance, run DI water through new tubes for one hour to exercise them before using them for running samples. To do this, select INSTRUMENT from the Main Menu and then select OPERATION.

The INSTRUMENT:OPERATION screen will appear. Set the Pump Rate flow to the standard rate for 5 mL/min (Type R and M and 5 Enter). Wait for one hour and then connect the tubing to the appropriate fluids.

NOTE: This procedure only needs to be done once, when the tubes are new and unused.

7.5.4 Replacing the Lamp

The mercury lamp has a life of about 2000 hours, between four months and a year of use. The lamp needs to be replaced if the relative absorbance of a standard has changed significantly while the optical cell is clean. If the lamp is suspected, it is faster to replace the lamp and recalibrate than to clean the optical cell.

NOTE: Before installation, clean the new lamp quartz with methanol and wipe it dry. Do not get finger prints on the lamp and do not face the printing on the lamp toward the optical cell.

- Turn off the lamp (press the blue button on the front of the instrument).
- Remove the front panel of the instrument (lift up and out).
- Remove the optical assembly.
- Remove the two screws on the lamp housing and take off the lamp cover.
- Twist the lamp 90° and slide it straight out.
- Insert the new lamp and rotate it 90° in the reverse direction to secure it in place. Make sure that the lettering on the lamp will be facing to the left of the instrument when it has been reinstalled. If it is not, remove the lamp and reinsert it correctly.
- Replace the optical assembly.

7.5.5 Cleaning the Optical Cell

If the relative absorbance of standards differs significantly from that of previous calibrations, the optical cell (located inside the front panel) may be dirty and must be cleaned:

- Turn the lamp and the power off and remove the front panel by lifting it up and out.

- Remove the optics clamps, disconnect the detector, and rotate and lift out the assembly. Disconnect the gas lines.
- Remove the six screws holding the lamp spacer and the detector spacer onto the optical cell.
- Inspect the two ends with the lenses. If the external surface of the lenses appear to be the only contaminant, then clean. To clean use methanol. Install if no other cleaning is necessary.
- Disassemble the optical cell (using the allen wrench provided on the inside of the front cover) by removing (in order) the screws, lens, and gasket at each end.
- Carefully clean the inside of the cell with laboratory glassware cleaner, taking care not to scratch the inside surfaces. Rinse thoroughly, first with water and then with DI water. Dry the cell in the oven (free of contaminants) for one hour at approximately 40 - 50°C.
- Clean the lenses with laboratory glassware cleaner and rinse thoroughly with hot tap water. Flush lightly with methanol and dry by air or vacuum oven (maximum 50°C).
- Replace the gaskets (this is recommended although not required unless the gasket shows signs of wear) and reassemble the optical cell. Cleaning of the gaskets should only be done with DI water.

7.5.6 Replacing the Liquid Gas Separator

- The liquid gas separator (transparent block on the chemical panel) should only need to be replaced once every one to three years, depending on the amount of use it receives.
- To replace the separator, shut off the gas and liquid flow and flush the tubing with DI Water for safety purposes. Disconnect the four lines and remove the two screws. Remove the unit from the system, screw on a new one, reconnect the four lines, and turn the gas and liquid flow back on.

7.5.7 Replacing Internal Tubing

Internal gas and Teflon tubes should last indefinitely and should not need to be replaced. Periodically inspect all tubing for restrictions or blockages. If tubing should need to be replaced, do so one piece at time to avoid any confusion while making connections.

7.6 Sample Analysis

7.6.1 Preparing the System

The following procedures must be performed each morning before warming up the system:

- Change the drying tube. Refer to maintenance, Section 7.5 for instructions.

- Release the clamps and check the pump tubing for wear. Under normal use, the tubes will need to be replaced once a week. To replace the tubing, refer to maintenance, Section 7.5 for instructions.
- Check the reductant volume and refresh, if needed.
- Clean the rinse tank using standard lab cleaning practices, add fresh rinse.
- If the lamp has been off then turn on the lamp power and allow the lamp to warm up for at least 45 minutes.
- Start up the system.

7.6.2 Start-up Procedures

The start-up routine used will depend on the current state of the system. If it is in Overnite mode, use the Warmstart macro (15 minute warm-up). If the system has been completely powered down, run the Coldstart macro instead (3 hour warm-up).

7.6.3 Software Setup

- In order to run samples, enter all necessary information regarding the protocol, sample ID's, calibration values, and autosampler parameters into the software. This information is entered into a series of screens which are accessed from the Main Menu. (Display the Main Menu at any time by pressing the F1 key)
- Perform each of the following steps in sequence to set up the software. When these steps have been completed, the instrument will be able to run samples automatically.

NOTE: The steps below comprise the basic daily software setup sequence. The software also contains numerous advanced functions. Refer to the PS Series Reference Guide for a detailed description of the many other keys and functions available for use with this system.

7.6.4 Name the Protocol

From the 'Runner', click the toolbar button labeled 'DB' on the 'Database' command button on the 'Main' tab. From the 'Database', select 'File' from the pull down menu. Select 'New Protocol'. Enter a name in the 'Protocol Name' dialog box that appears. Select one of the check boxes in the 'Protocol type' group. This ensures the correct analytical conditions for the concentration range desired.

7.6.5 Name the Folder

Data set name is added from the WinHg Runner. Click on 'File' and select 'New Dataset'. 'Add New Batch' will pop up when you hit 'Enter'. New batch can also be added from the sample tab on the Runner.

7.6.6 Verify Values and Integration Times

Check to make sure that all values and integration times are correct for running the samples:

- From the Main Menu, select PROTOCOL, then select SET Values. The Set Values screen appears.
- For normal operation, enter the following values (as Illustrated below):

Number of Integrations:	1
Uptake time	10
Weight	N
Dilution	N
Percent Recovery	N

- Press F1 to return to the Main Menu.

7.6.7 Enter values for on/offs, times, and gains

All the information entered on the PROTOCOL tab on the WinHg database.

7.6.8 Enter the Calibration Standard Concentrations:

From the WinHg Database, select the 'Line Info' tab. Calibration standards and concentrations are entered here.

7.6.9 Reset the Calibration Intensity Data

The calibration can be reset from 2 different places. One option is from the WinHg Runner. Click the standards tab, then click on the 'New Cal Reset' button and 'OK'. Another option is from the WinHg Database. Click on the 'Cal Curve' tab and click the 4 buttons in the reset box.

7.6.10 Set the Autosampler Rinse Time

Pump rinse times and rates are setup in the protocol through the WinHg Database tab. Rinse is set at 50 seconds and the uptake is set at 10 seconds.

7.6.11 Set up the Racks

To launch the Rack Edit application, either click the 'Rack Editor' button the Runner 'Main' tab or click the Autosampler rack icon on the toolbar.

7.6.12 Define start-to finish sample sequence

Click on the 'Sample' tab on the WinHg Runner. In the 'Autosampler run' group, click on the combo box for Station 1 and select the rack to be run. Using the spin boxes, set the starting and ending cups. Click on 'Run Auto' to being analysis.

7.6.13 Running Samples

NOTE: Optimum Concentration Range = 0.2 ug/L - 5 ug/L

Once the rack and ranges are put in on the 'Autosample run' box on the sample tab, click the 'Run Auto' button to begin analysis.

7.6.14 Shutdown Procedures

There are two methods for shutting down the instrument. Under routine operation, when the system is used daily, only the lamp is shut off (system power remains on) and the Overnite routine is used to put the unit into a "sleep mode". If the system is to be completely turned off and not used for an extended period of time , or if it is to be shipped or moved, use the long-term Shutdown routine instead. These two methods are described below. For weekends or periods of "sleep" greater than 24 hours it is recommended to turn off the mercury lamp using the blue button.
NOTE: Before shutting down the instrument, the system must have beeped to indicate completion of the last procedure, and the word "Idle" should appear in the "State field in the top left of the displayed screen.

7.6.15 Short-Term (Overnite Macro)

Return to the WinHg Runner and click on the 'Control' tab. In the gas group, click on the 'Off' button, then in the 'Pump Group', click the 'Stand by' button. This will allow the instrument to autocycle to keep tubing clear of clogs.

7.6.16 Long-Term (Shutdown Macro)

For long-term shutdown, exit the software by selecting 'File' and then 'Exit' on the WinHg Runner pull-down menu.

7.7 Documentation

7.7.1 Instrument Run-Log

The analysis of samples and standards is documented within the instrument run log (Attachment 1) and supported by the instrument print-out. The runlog must be completed for each days analysis.

7.7.2 Traceability of Standards

Custom made and single element stock standard solution which are traceable to NIST or EPA are purchased. On receipt, each standard is recorded in LabNet (LIMS) and is issued a unique source ID#. The manufacturer, lot #, date received, expiration date, date of verification and the initials of the recording analyst are entered into the system.

7.7.3 Data Review

Analytical data goes through a 200% review cycle. The analyst and a trained data reviewer perform the reviews according to the criteria established on the data review checklist (Attachment 2). Upon the first 100% review, the checklist is initialed and dated as reviewed. The package, with its review sheet, comments and any corrective action reports (CARs) is submitted to the supervisor, section manager, or peer reviewer for a second review. Once again, the checklist is initialed and dated by the second reviewer. The completed checklist remains on file with the original data.

8.0 QUALITY CONTROL

8.1 QC Summary

The laboratory generates annual statistically generated control limits and these can be used when requested by the client, contract or QAPP. These limits are based on the successive analysis of LCSs.

8.1.1 Calibration curve must be composed of a minimum of a blank and 5-standards. A least square fit linear calibration curve must have a minimum correlation coefficient of 0.995, which must be reported with the raw data.

8.1.2 ICV and ICB will be performed at the beginning of an analytical sequence. The ICV must not vary more than - a) 10% for EPA 245.5, SW-846 & CLP methods or b) 5% for EPA 245.1 method from its true value and must be prepared from a different source than the calibration curve standards.

Calibration verification will be performed with a CCV and CCB every 10 samples and at the end of the analysis. The CCV must not vary more than a) 20% for SW-846 methods or b) 10% for EPA & CLP methods from its true value and must be prepared from a different source than the calibration curve standards. (Note: The LabNet (LIMS) QC criteria code for the CCV is set at the default limit of 90-110% for all methods.) The CCB must be < Reporting Limit (EPA / SW-846) and < CRDL (CLP).

8.1.3 Dilute samples if they are more concentrated than the highest standard or if they fall on the plateau of a calibration curve (dilute with a digested blank containing all reagents, or repeat the analysis using a smaller sample volume).

8.1.4 A minimum of one MB must be analyzed per sample batch to determine if contamination has occurred

8.1.5 An LCS will be included with each batch of 10 (drinking waters and EPA 245.1) or 20 (EPA 245.5, SW-846 or CLP) samples. The analyzed result must not vary more than 20% from the true value. For EPA Method 245.1, the LCS acceptance limits are 85-115%.

8.1.6 Matrix spike and duplicate samples are analyzed with each batch of 10 (drinking waters and EPA 245.1) or 20 (EPA 245.5, SW-846 or CLP) samples.

8.2 Corrective Actions

When an out-of-control situation occurs, the analysts must use his/her best analytical judgment and available resources to determine the corrective action to be taken. The out-of-control situation may be caused by more than one variable. The analyst should seek the assistance of his/her immediate supervisor, section manager, QA personnel, or other experienced staff if he/she is uncertain of the cause of the out-of-control situation. The test must not be resumed until the source of the problem and an in-control status is attained. All samples associated with the out-of-control situation should be reanalyzed. Out-of-control data must never be released without approval of the supervisor, section manager, project manager, QA personnel or the laboratory manager.

Listed below are steps that must be taken when an out-of-control situation occurs:

- demonstrate that all the problems creating the out-of-control situation were addressed
- document the problem and the action which was taken to correct the problem on a CAR
- document on the CAR that an in-control has been achieved and receive approval (signature) of the supervisor, section manager, QA personnel, or the laboratory manager prior to the release of any analytical data associated with the problem.

QC Indicator	Suggested Corrective Actions
Calibration Curve	• reanalyze the standard curve; • prepare a new stock and/or working standards; • check the reagents/solutions and prepare fresh if necessary.
Initial Calibration Verification (ICV)	• repeat ICV to verify proper preparation; • prepare new ICV from original stock; • recalibrate with a new standard curve; • prepare new stock and/or working standards; • check reagents/solutions and prepare fresh if necessary.
Initial Calibration Blank (ICB)	• prepare new ICB to verify proper preparation; • verify that the instrument base-line is stable and perform necessary maintenance, cleaning, etc.. to achieve stability; • determine the source of contamination by the process of elimination, carryover from a previous analysis or reagent contamination and correct the problem; • check reagents/solutions and prepare fresh if necessary; • correct for any contamination and reanalyze ICB and any associated samples.
Laboratory Control Sample (LCS)	<u>If LCS is low:</u> • reanalyze LCS to verify that it is out-of-control; • determine the source of error within the preparation procedure, repeat the sample set, write a CAR. <u>If the LCS is high:</u> • reanalyze LCS to verify that it is out-of-control; • determine the source of error within the preparation procedure, repeat the sample set; • determine if the high result is due to contamination; • check for contamination of reagents, LCS stock solution, or preparation area; • correct for contamination, reanalyze.
Method Blank (MB)	• reanalyze the MB to verify that it is beyond the reporting limit; • determine the source of contamination; • determine if the high result is due to contamination; • check for contamination of reagents or preparation area; • correct for contamination, reanalyze set; • in the extreme case where all samples in the set are at least 10X > the MB, reanalysis will not be required. However, a CAR and approval will be necessary.
Matrix Duplicate (MD)	• the sample must be reprocessed and reanalyzed; • if the reanalysis results in data that is still out of the control limit, then the sample will be ticked with a "*"; • regardless of the outcome of the reanalysis, a CAR will be written and approved by the Section Manager.
Matrix Spike (MS)	• the sample must be reprocessed and reanalyzed; • if the reanalysis results in data that is still out of the control limit, then the sample will be ticked with a "N"; • regardless of the outcome of the reanalysis, a CAR will be written and approved by the Section Manager.

QC Indicator	Suggested Corrective Actions
Continuing Calibration Verification (CCV)	• repeat CCV to verify proper preparation; • prepare new CCV from original stock; • check for instrument base-line drift or a change in one or more of the reagents; • check reagents/solutions and prepare fresh if necessary; • recalibrate with a new standard curve and repeat all samples since the previous in control CCV; • never dispose of any samples until you are sure that all QC, especially the CCV, are within the control limits.
Continuing Calibration Blank (CCB)	• prepare new CCB to verify proper preparation; • verify that the instrument base-line is stable and/or perform necessary maintenance, cleaning, etc.. to achieve stability; • determine the source of contamination by the process of elimination, carryover from a previous analysis or reagent contamination and correct the problem, • check reagents/solutions and prepare fresh if necessary; • correct for any contamination and reanalyze CCB and any associated samples; • never dispose of any samples until you are sure that all QC, especially the CCB are within the control limits.
Summary	• If any of the ICV, ICB, CCV or CCB results are out-of-control for any element, the instrument is restandardized and the samples associated with the out-of-control elements are reanalyzed. • If the MB or LCS are out-of-control for any element, the samples are redigested. An exception is if the sample concentrations are $\geq$ 10X the MB contamination, the results are reported as is. • If any of the MD or MS results are out-of-control, a reanalysis is performed if there is sufficient sample. If there is insufficient sample, or the reanalysis is still out-of-control, the client is notified of the poor results via a case narrative that is sent with the data report. • CARs are available for out-of-control MB, LCS, MS and MD problems. These forms are completed by the analyst performing the analysis. The forms are then reviewed and signed by the supervisor or section manager. The signed forms are kept on file within the laboratory department and are used to prepare the case narrative (if applicable).

9.0 DATA ANALYSIS AND CALCULATIONS

Perform a linear regression or quadratic fit analysis of the calibration standard results. Compare sample results to the curve to determine the mercury concentration.

9.1 Water ug/L Hg = ug/L x Dilution Factor (Where L = Final digestate volume)

9.2 Soil

$$\text{mg/kg Hg} = \frac{(\text{ug/L}) \times L \times \text{Dilution Factor}}{\text{wt(g)} \times \text{fraction solids}}$$

(Where L = Final digestate volume)

NOTE: All dry weight corrections are made in LabNet at the time the final report is prepared.

9.3 Accuracy

$$\%R = \frac{(A_T - A_O)}{A_F} \times 100$$

Where:
A_T = Total amount recovered in fortified sample
A_O = Amount recovered in unfortified sample
A_F = Amount added to sample

9.4 Precision

$$RPD = \frac{|C_1 - C_2|}{(C_1+C_2)/2} \times 100$$

Where:
C_1 = First measurement value
C_2 = Second measurement value

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

10.1 Waste Streams Produced by this Method

- Waste from this process goes into the "Corrosive Wastewater" wastestream.
- Single component standards should not be mixed into the waste streams unless approved by the Waste Coordinator. All standards with Hazardous constituents will be turned in to the waste technician for disposal.

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Section 1.0.

13.0 ATTACHMENTS

Attachment 1: Example: Instrument Maintenance Log and LabNet Forms
Attachment 2: Example: Data Review Checklist

Historical File:

Revision 00: 10/03/90	Revision 06: 03/16/00
Revision 01: 08/09/91	Revision 07: 05/23/01
Revision 02: 03/19/93	Revision 08: 09/06/02
Revision 03: 10/18/95	Revision 09: 03/29/04
Revision 04: 01/24/97	Revision 10: 03/22/05
Revision 05: 03/31/99	

Reasons for Change, Revision 10:

- Annual Review –
- Maintenance Log added as attachment
- Soil RL changed to reflect hot block final volume of 50 mLs.

U:\QC\SOP\ME\UME-245.1.DOC

Attachment 1:

Example: Instrument Maintenance Log and LabNet Forms

STL Chicago
PS200 Leeman Mercury Analyzer – HG3
Instrument Maintenance Log

Page No.______________

	Date/Initials	Date/Initials	Date/Initials	Date/Initials	Date/Initials	Date/Initials	Date/Initials
Daily Maintenance:							
Change Drying Tube							
Clean and Refill Rinse Tank							
Clean Sample Tip							
Check/Clean Optical Cell (Clean when reference intensity is <300,000)							

Weekly Maintenance:							
Change Pump Tubing							
Change Activated Carbon and Quartz Wool							

Comments:____

Any Maintenance/Repair/Part Replacement performed that is not listed above must be documented in the Comments sections

Reviewer Signature:________________________________ Date:________________

SW846 Digestion (Hg)
Method Code..: HGSWD
Batch Code...: 143878

Status.......: RVWD
Batch Date...: 03/14/05
Batch Time...: 1442

User Name......: gok
QC Code........:
Calc Code......: PREPFO

Location Code..: 57222
Equipment Code.: HG3
Import Code....:

SAMPLE: Grp	Pos	Sample ID	Dilution	TEST CODE / TEST POS / Date / Time	DIGHG 1
1	1	__S_S1_M04KSTK001_		3/10/05 1630	0
1	2	__S_S2__		3/10/05 1630	0
1	3	__S_S3__		3/10/05 1630	0
1	4	__S_S4__		3/10/05 1630	0
1	5	__S_S5__		3/10/05 1630	0
1	6	__S_S6__		3/10/05 1630	0
1	7	__S_MB__		3/10/05 1630	0
1	8	__S_LCS_M04LSTK010_7		3/10/05 1630	0
1	9	234659_2_S___		3/10/05 1630	0
1	10	234670_1_S___		3/10/05 1630	0
1	11	234670_2_S___		3/10/05 1630	0
1	12	234783_1_S___		3/10/05 1630	0
1	13	234783_2_S___		3/10/05 1630	0
1	14	234822_1_S___		3/10/05 1630	0
1	15	234822_13_S___		3/10/05 1630	0
1	16	234833_1_S___		3/10/05 1630	0
1	17	234842_1_S___		3/10/05 1630	0
1	18	234842_1_S_MD__17		3/10/05 1630	0
1	19	234842_1_S_MS_M04KSTK001_17		3/10/05 1630	0
1	20	234842_1_S_MSD_M04KSTK001_17		3/10/05 1630	0
1	21	234842_2_S___		3/10/05 1630	0
1	22	234842_3_S___		3/10/05 1630	0
1	23	234842_4_S___		3/10/05 1630	0
1	24	234842_5_S___		3/10/05 1630	0
1	25	234842_6_S___		3/10/05 1630	0
1	26	234855_4_O___		3/10/05 1630	0
1	27	234855_8_S___		3/10/05 1630	0

SW846 Digestion (Hg) Report Date: 3/22/05 11:41

Method Code..: HGSWD	Batch Date...: 03/14/05	QC Code........:	Equipment Code.: HG3
Batch Code...: 143878	Batch Time...: 1442	Calc Code......: PREPFO	Import Code....:
Status.......: RVWD	User Name....: gok	Location Code..: 57222	

BATCH:	Item	Description	Description Information
	1	Analyst:	GEORGE KLEE JR.
	2	Reviewer:	
	3	Equipment ID:	1173
	4	Wavelength: 253.7nm Cell length: 20.5cm	
	5	Water Bath Temp: Initial(Limits 90C-95C)	
	6	Water Bath Temp: Final	
	7	Block Digestor Temp: Initial (90C-95C)	955
	8	Thermometer ID: Correction Factor:	1173 +2
	9	Repipettor Volume Check:	OK
	10	HNO3 Lot#:	A22035
	11	HCL Lot#:	5587 A06A22
	12	H2SO4 Lot#:	5557 A2A0A08
	13	KMnO4 Lot#:	7056 X49655
	14	SnCl2-H2O Lot#:	A40600
	15	NH2OH-HCL Lot#:	Y28599
	16	K2S2O8 Lot#:	T44H13
	17	NaCl Lot#:	43234351
	18	Date Sample Prepped:	03/10/05
	19	Prep Time In:	1630
	20	Prep Time Out:	1700

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGHG Text	MLI mL	MLF mL	WEIGHT g	PREPF N/A
	1	1	__S_S1_M04KSTK001_		Complete		50	0.60	83.3333
	1	2	__S_S2__		Complete		50	0.60	83.3333
	1	3	__S_S3__		Complete		50	0.60	83.3333
	1	4	__S_S4__		Complete		50	0.60	83.3333
	1	5	__S_S5__		Complete		50	0.60	83.3333
	1	6	__S_S6__		Complete		50	0.60	83.3333
	1	7	__S_MB__		Complete		50	0.60	83.3333
	1	8	__S_LCS_M04LSTK010_7		Complete		50	0.60	83.3333
	1	9	234659_2_S___		Complete		50	0.60	83.3333
	1	10	234670_1_S___		Complete		50	0.60	83.3333
	1	11	234670_2_S___		Complete		50	0.60	83.3333

SW846 Digestion (Hg) Report Date: 3/22/05 11:41

Method Code..: HGSWD	Batch Date...: 03/14/05	QC Code........:	Equipment Code.: HG3
Batch Code...: 143878	Batch Time...: 1442	Calc Code......: PREPFO	Import Code....:
Status.......: RVWD	User Name....: gok	Location Code..: 57222	

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGHG Text	MLI mL	MLF mL	WEIGHT g	PREPF N/A
	1	12	234783_1_S___		Complete		50	0.60	83.3333
	1	13	234783_2_S___		Complete		50	0.60	83.3333
	1	14	234822_1_S___		Complete		50	0.60	83.3333
	1	15	234822_13_S___		Complete		50	0.60	83.3333
	1	16	234833_1_S___		Complete		50	0.60	83.3333
	1	17	234842_1_S___		Complete		50	0.60	83.3333
	1	18	234842_1_S_MD__17		Complete		50	0.60	83.3333
	1	19	234842_1_S_MS_M04KSTK001_17		Complete		50	0.60	83.3333
	1	20	234842_1_S_MSD_M04KSTK001_17		Complete		50	0.60	83.3333
	1	21	234842_2_S___		Complete		50	0.60	83.3333
	1	22	234842_3_S___		Complete		50	0.60	83.3333
	1	23	234842_4_S___		Complete		50	0.60	83.3333
	1	24	234842_5_S___		Complete		50	0.60	83.3333
	1	25	234842_6_S___		Complete		50	0.60	83.3333
	1	26	234855_4_O___		Complete		50	0.60	83.3333
	1	27	234855_8_S___		Complete		50	0.60	83.3333

SAMPLE:	Grp	Pos	Sample ID	Dilution	DLFAC N/A	VOL mL			
	1	1	__S_S1_M04KSTK001_		1.0000	50			
	1	2	__S_S2__		1.0000	50			
	1	3	__S_S3__		1.0000	50			
	1	4	__S_S4__		1.0000	50			
	1	5	__S_S5__		1.0000	50			
	1	6	__S_S6__		1.0000	50			
	1	7	__S_MB__		1.0000	50			
	1	8	__S_LCS_M04LSTK010_7		1.0000	50			
	1	9	234659_2_S___		1.0000	50			
	1	10	234670_1_S___		1.0000	50			
	1	11	234670_2_S___		1.0000	50			
	1	12	234783_1_S___		1.0000	50			
	1	13	234783_2_S___		1.0000	50			
	1	14	234822_1_S___		1.0000	50			
	1	15	234822_13_S___		1.0000	50			

SW846 Digestion (Hg) Report Date: 3/22/05 11:41

Method Code..: HGSWD Batch Date...: 03/14/05 QC Code........: Equipment Code.: HG3
Batch Code...: 143878 Batch Time...: 1442 Calc Code......: PREPFO Import Code....:
Status.......: RVWD User Name....: gok Location Code..: 57222

SAMPLE:	Grp	Pos	Sample ID	Dilution	DLFAC N/A	VOL mL			
	1	16	234833_1_S___		1.0000	50			
	1	17	234842_1_S___		1.0000	50			
	1	18	234842_1_S_MD__17		1.0000	50			
	1	19	234842_1_S_MS_M04KSTK001_17		1.0000	50			
	1	20	234842_1_S_MSD_M04KSTK001_17		1.0000	50			
	1	21	234842_2_S___		1.0000	50			
	1	22	234842_3_S___		1.0000	50			
	1	23	234842_4_S___		1.0000	50			
	1	24	234842_5_S___		1.0000	50			
	1	25	234842_6_S___		1.0000	50			
	1	26	234855_4_O___		1.0000	50			
	1	27	234855_8_S___		1.0000	50			

*** RUN LOG *** (V2)

3/22/05 11:38

Mercury (CVAA) Solids
Method Code..: 7471
Batch Code...: 143880

Status.......: RVWD
Batch Date...: 03/14/05
Batch Time...: 1456

User Name......: gok
QC Code.........: METHG
Calc Code......:

Location Code..: 57222
Equipment Code.: HG3
Import Code....:

SAMPLE: Grp	Pos	Sample ID	Dilution	TEST CODE / TEST POS / Date / Time	HG (1)
1	1	__S_S1_M04KSTK001_		3/11/05 1320	
1	2	__S_S2__		3/11/05 1322	
1	3	__S_S3__		3/11/05 1324	
1	4	__S_S4__		3/11/05 1326	
1	5	__S_S5__		3/11/05 1328	
1	6	__S_S6__		3/11/05 1331	
1	7	___ICV_M04LSTK010_		3/11/05 1333	0
1	8	___ICB__		3/11/05 1336	0
1	9	___CRA_M04KSTK001_		3/11/05 1338	0
1	10	__S_MB__		3/11/05 1340	0
1	11	__S_LCS_M04LSTK010_10		3/11/05 1342	0
1	12	234659_2_S___		3/11/05 1344	0
1	13	234670_1_S___		3/11/05 1347	0
1	14	234670_2_S___		3/11/05 1350	0
1	15	234783_1_S___		3/11/05 1353	0
1	16	234783_2_S___		3/11/05 1356	0
1	17	___CCV_M04LSTK010_		3/11/05 1403	0
1	18	___CCB__		3/11/05 1406	0
1	19	234822_1_S___		3/11/05 1408	0
1	20	234822_13_S___		3/11/05 1411	0
1	21	234833_1_S___		3/11/05 1414	0
1	22	234842_1_S___		3/11/05 1416	0
1	23	234842_1_S_MD__22		3/11/05 1419	0
1	24	234842_1_S_MS_M04KSTK001_22		3/11/05 1421	N
1	25	234842_1_S_MSD_M04KSTK001_22		3/11/05 1424	N
1	26	234842_2_S___		3/11/05 1427	0
1	27	234842_3_S___		3/11/05 1429	0
1	28	234842_4_S___		3/11/05 1432	0

3/22/05 11:38

Mercury (CVAA) Solids
Method Code..: 7471
Batch Code...: 143880

Status.......: RVWD
Batch Date...: 03/14/05
Batch Time...: 1456

User Name......: gok
QC Code........: METHG
Calc Code......:

Location Code..: 57222
Equipment Code.: HG3
Import Code....:

SAMPLE: Grp	Pos	Sample ID	Dilution	TEST CODE / TEST POS / Date / Time	HG 1
1	29	___CCV_M04LSTK010_		3/11/05 1434	
1	30	___CCV_M04LSTK010_		3/11/05 1437	0
1	31	___CCB__		3/11/05 1439	0
1	32	234842_5_S___		3/11/05 1441	0
1	33	234842_6_S___		3/11/05 1444	0
1	34	234855_4_O___		3/11/05 1446	0
1	35	234855_8_S___		3/11/05 1448	0
1	36	___CCV_M04LSTK010_		3/11/05 1451	0
1	37	___CCB__		3/11/05 1453	0
1	38	__S_MB__		3/11/05 1455	0
1	39	__S_LCS_M04LSTK010_38		3/11/05 1512	0
1	40	234873_1_S___		3/11/05 1515	0
1	41	234873_1_S_MD__40		3/11/05 1517	0
1	42	234873_1_S_MS_M04KSTK001_40		3/11/05 1519	0
1	43	234873_1_S_MSD_M04KSTK001_40		3/11/05 1521	0
1	44	234873_2_S___		3/11/05 1524	0
1	45	___CCV_M04LSTK010_		3/11/05 1526	0
1	46	___CCB__		3/11/05 1529	0
1	47	234873_3_S___		3/11/05 1531	0
1	48	234873_4_S___		3/11/05 1533	0
1	49	234873_5_S___		3/11/05 1535	0
1	50	234873_6_S___		3/11/05 1537	0
1	51	234873_7_S___		3/11/05 1539	0
1	52	234873_8_S___		3/11/05 1541	0
1	53	234873_9_S___		3/11/05 1543	0
1	54	234873_10_S___		3/11/05 1545	0
1	55	234873_11_S___		3/11/05 1548	0
1	56	234873_12_S___		3/11/05 1550	0

3/22/05 11:38

Mercury (CVAA) Solids
Method Code..: 7471
Batch Code...: 143880

Status.......: RVWD
Batch Date...: 03/14/05
Batch Time...: 1456

User Name......: gok
QC Code........: METHG
Calc Code......:

Location Code..: 57222
Equipment Code.: HG3
Import Code....:

SAMPLE: Grp	Pos	Sample ID	Dilution	TEST CODE / TEST POS / Date / Time	HG 1
1	57	___CCV_M04LSTK010_		3/11/05 1552	0
1	58	___CCB__		3/11/05 1554	0
1	59	234873_13_S___		3/11/05 1556	0
1	60	234873_14_S___		3/11/05 1559	0
1	61	234873_15_S___		3/11/05 1601	0
1	62	234873_16_S___		3/11/05 1603	0
1	63	234873_17_S___		3/11/05 1605	0
1	64	234873_18_S___		3/11/05 1607	0
1	65	234873_19_S___		3/11/05 1609	0
1	66	___CCV_M04LSTK010_		3/11/05 1612	0
1	67	___CCB__		3/11/05 1614	0

Mercury (CVAA) Solids Report Date: 3/22/05 11:38

Method Code..: 7471	Batch Date...: 03/14/05	QC Code........: METHG	Equipment Code.: HG3
Batch Code...: 143880	Batch Time...: 1456	Calc Code......:	Import Code....:
Status.......: RVWD	User Name....: gok	Location Code..: 57222	

Grp	Smp	Sample ID	Pos	Test	Result	Known	Original	Alternate	QC Res	F	QC Res	F
1	7	___ICV_M04LSTK010_	1	HG	2.034483	1000000			102			
1	8	___ICB__	1	HG	0.0866							
1	9	___CRA_M04KSTK001_	1	HG	0.284826	1000			142			
1	10	__S_MB__	1	HG	0.113689							
1	11	__S_LCS_M04LSTK010_10	1	HG	2.007891	1000000	0.113689		100			
1	17	___CCV_M04LSTK010_	1	HG	0.863191	1000000			86			
1	18	___CCB__	1	HG	-0.0336							
1	23	234842_1_S_MD__22	1	HG	0.833016		0.69038		18.7			
1	24	234842_1_S_MS_M04KSTK001_22	1	HG	1.182848	1000	0.69038		49	N		
1	25	234842_1_S_MSD_M04KSTK001_22	1	HG	1.246989	1000	0.69038	1.182848	56	N	13.3	
1	30	___CCV_M04LSTK010_	1	HG	0.932352	1000000			93			
1	31	___CCB__	1	HG	-0.08577							
1	36	___CCV_M04LSTK010_	1	HG	0.919853	1000000			92			
1	37	___CCB__	1	HG	-0.12177							
1	38	__S_MB__	1	HG	-0.03533							
1	39	__S_LCS_M04LSTK010_38	1	HG	2.358481	1000000	-0.03533		118			
1	41	234873_1_S_MD__40	1	HG	0.082625		0.114578				0.03195	
1	42	234873_1_S_MS_M04KSTK001_40	1	HG	1.146921	1000	0.114578		103			
1	43	234873_1_S_MSD_M04KSTK001_40	1	HG	1.161093	1000	0.114578	1.146921	105		1.9	
1	45	___CCV_M04LSTK010_	1	HG	1.0616	1000000			106			
1	46	___CCB__	1	HG	0.006509							
1	57	___CCV_M04LSTK010_	1	HG	1.082989	1000000			108			
1	58	___CCB__	1	HG	0.001828							
1	66	___CCV_M04LSTK010_	1	HG	1.116589	1000000			112			
1	67	___CCB__	1	HG	0.01655							

Mercury (CVAA) Solids

Report Date: 3/22/05 11:38

Method Code..: 7471 Batch Date...: 03/14/05 QC Code........: METHG Equipment Code.: HG3
Batch Code...: 143880 Batch Time...: 1456 Calc Code......: Import Code....:
Status.......: RVWD User Name....: gok Location Code..: 57222

SAMPLE:	Grp	Pos	Sample ID	Dilution	HG ug/L
	1	1	__S_S1_M04KSTK001_		7661
	1	2	__S_S2__		14169
	1	3	__S_S3__		23962
	1	4	__S_S4__		43168
	1	5	__S_S5__		114901
	1	6	__S_S6__		199699
	1	7	___ICV_M04LSTK010_		2.034483
	1	8	___ICB__		0.0866
	1	9	___CRA_M04KSTK001_		0.284826
	1	10	__S_MB__		0.113689
	1	11	__S_LCS_M04LSTK010_10		2.007891
	1	12	234659_2_S___		1.448405
	1	13	234670_1_S___		2.340857
	1	14	234670_2_S___		0.359034
	1	15	234783_1_S___		2.759537
	1	16	234783_2_S___		0.869309
	1	17	___CCV_M04LSTK010_		0.863191
	1	18	___CCB__		-0.0336
	1	19	234822_1_S___		2.209909
	1	20	234822_13_S___		0.434706
	1	21	234833_1_S___		0.640463
	1	22	234842_1_S___		0.69038
	1	23	234842_1_S_MD__22		0.833016
	1	24	234842_1_S_MS_M04KSTK001_22		1.182848
	1	25	234842_1_S_MSD_M04KSTK001_22		1.246989
	1	26	234842_2_S___		0.348261
	1	27	234842_3_S___		0.114421
	1	28	234842_4_S___		0.202565
	1	29	___CCV_M04LSTK010_		0.777818
	1	30	___CCV_M04LSTK010_		0.932352
	1	31	___CCB__		-0.08577
	1	32	234842_5_S___		0.367872
	1	33	234842_6_S___		0.03284
	1	34	234855_4_O___		-0.1178
	1	35	234855_8_S___		1.30522
	1	36	___CCV_M04LSTK010_		0.919853
	1	37	___CCB__		-0.12177
	1	38	__S_MB__		-0.03533
	1	39	__S_LCS_M04LSTK010_38		2.358481
	1	40	234873_1_S___		0.114578
	1	41	234873_1_S_MD__40		0.082625
	1	42	234873_1_S_MS_M04KSTK001_40		1.146921
	1	43	234873_1_S_MSD_M04KSTK001_40		1.161093
	1	44	234873_2_S___		0.164023
	1	45	___CCV_M04LSTK010_		1.0616
	1	46	___CCB__		0.006509
	1	47	234873_3_S___		0.217888
	1	48	234873_4_S___		0.084429
	1	49	234873_5_S___		0.250965
	1	50	234873_6_S___		0.177437
	1	51	234873_7_S___		0.066937
	1	52	234873_8_S___		0.081945
	1	53	234873_9_S___		0.184523
	1	54	234873_10_S___		0.237133
	1	55	234873_11_S___		0.192995
	1	56	234873_12_S___		0.314321
	1	57	___CCV_M04LSTK010_		1.082989
	1	58	___CCB__		0.001828
	1	59	234873_13_S___		0.20382
	1	60	234873_14_S___		0.318243
	1	61	234873_15_S___		0.035794
	1	62	234873_16_S___		0.360394
	1	63	234873_17_S___		0.199872
	1	64	234873_18_S___		0.127966

Mercury (CVAA) Solids

Report Date: 3/22/05 11:38

Method Code..: 7471	Batch Date...: 03/14/05	QC Code........: METHG	Equipment Code.: HG3
Batch Code...: 143880	Batch Time...: 1456	Calc Code......:	Import Code....:
Status.......: RVWD	User Name....: gok	Location Code..: 57222	

SAMPLE:	Grp	Pos	Sample ID	Dilution	HG ug/L				
	1	65	234873_19_S___		0.300018				
	1	66	___CCV_M04LSTK010_		1.116589				
	1	67	___CCB__		0.01655				

Attachment 2.

Example: Data Review Checklist

STL Chicago
INORGANIC CLP / LEVEL IV DATA REVIEW CHECKLIST

Site Name: ______________________ Primary Reviewer: ______________________ Review Date: ____________
JOB Number: ______________________ Secondary Reviewer: ______________________ Review Date: ____________
No. of Samples/Matrix: a) WATER ______ b) SOIL ______ c) TCLP / SPLP ______ d) OTHER ______________

Metals List: a) TAL b) PP c) TCLP d) Other (______________________________________)
Report Level: **IDL** = a) CLP b) Non-CLP c) MDL d) Other ________ **CRDL** = a) CLP b) Client c) Default RL d) Other

TASK : CAR's ______	PRI REV	SEC REV	COMMENTS
LAB CHRON: 1) Matches COC			
2) Proper Prep Links: S-F6 (Routine) S-F9 (TCLP/SPLP)			
3) Sample Hold Times Met			
Cyanide Reported on Forms	Y / N		Method: a) CLP b) SW846 9010B/9014
Initial / Continuing Calibration Criteria Met (CRA/CRI requirements met if applicable)			
FORM 1: Matches Report LabNet Report Units / Test Matrix Match Form 1's Dilutions due to interference's resulted in elevated RL's			
FORM 3: Method Blanks < CRDL			
FORM 5A: MS Recoveries Acceptable Default Limits _____ Statistical Limits _____ Project Limits _____(S-F10 used to Clone By Project)			N
FORM 5B: PDS Performed			
FORM 6: Duplicate RPD Acceptable Default Limits _____ Statistical Limits _____ Project Limits _____(S-F10 used to Clone By Project)			*
FORM 7: LCS Recoveries Acceptable Default Limits _____ Statistical Limits ______ Project Limits _____(S-F10 used to Clone By Project)			^
FORM 8: MSA Analysis Performed			S
GFAA – Analytical Spike (AS) Recoveries Acceptable			W
GFAA – Repeat Analytical Recovery <40%			E
GFAA – Duplicate Injection Precision Met			M
FORM 9: Serial Dilution (SD) Acceptable			E
FORM 14's Correct			
RAW DATA: Complete (Match Batches to LabChron) a) Instr. Raw Data clearly displays the LabNet Batch number and includes the "Batch Worksheet" Report b) Prep Raw Data displays the LabNet Batch Number and includes the "Batch Worksheet" Report or "Raw Data" Report			

TASK : CAR's _______	PRI REV	SEC REV	COMMENTS

LabNet Batch Status Report Displays Data At RVWD Status			
Incomplete JOB Status Report reveals no Outstanding Data			
NARRATIVE: 1) Holding Times			
2) Method References			Method: a) CLP b) SW846 c) Other
3) % Recoveries / RPD's			
4) Analytical Difficulties/Typos			

COMMENTS:

QC CYCLE	REASON
1	
2	

STL Chicago
Mercury Data Review Checklist: Automated CV (PS 200)

Instrument ID: HG3 HG4 (circle one) **LabNet Batch No.:**______________

Analyst Initial(s):______________ **Date:** ______________

Copies: ______________ ______________
______________ ______________
______________ ______________
______________ ______________
______________ ______________

****

QC Type: a. CLP b. Standard c. TCLP d. Drinking Waters e. Solubles

I. Calibration:

Analyst Reviewer

1. Calibration is clearly documented.
   - ___ ___ a. c.c.: 0.995 to 1.000
   - ___ ___ b. y-intercept: **Std. QC**: < RL; **CLP QC**: < CRDL

2. Calibration Verification
   - **CLP QC**: Every 10 Sample Bottles
   - **Std. QC**: Every 20 Sample Bottles
   - **TCLP QC**: Every 20 Sample Bottles
   - **Drinking Waters:** Every 10 Sample Bottles
   - a. ICV/CCV **Std./SW-846:** ± 10% (ICV); ± 20% (CCV); (Note: CCV Default of +/-10% set in LabNet)
     CLP: ± 10% (ICV); ± 10% (CCV)
     ___ ___ **EPA 245.1:** ± 5% (ICV); ± 10% (CCV)
   - b. ICB/CCB **Std. QC**: < RL; **CLP QC**: < CRDL

3. CRA
   ___ ___ **CLP QC**: At CRDL; Analyzed each Calibration; No Limit; **Std. QC**: At CRDL; Analyzed Daily; ± RL

II. Sample Analysis:

Analyst Reviewer

1. Each Preparation Batch:
   - ___ ___ a. Must be clearly identified
   - ___ ___ b. Contains a maximum of 20 samples
   - ___ ___ c. 1 Prep Blank: **CLP:** < CRDL; **Std. QC:** < RL
   - ___ ___ d. 1 LCS: **Std./CLP:** 80-120% Rec. **EPA 245.1:** 85-115% Rec.
   - e. 1 Matrix Spike: **Std./CLP:** 75-125% Rec.; ***Unless*** the sample conc. exceeds the spike conc. by factor 4x.
     TCLP: > 50% Rec.; If <50%, MSA analysis is required
     ___ ___ **245.1:** 70-130% Rec.
   - f. 1 Matrix Duplicate: **Std.:** RPD/RSD limits are 20% ***Unless*** the sample conc. is <5x RL then ± RL
     CLP: RPD or RSD limits are 20%; ***Unless*** the sample conc. is <5x CRDL then
     ___ ___ ± CRDL applies.
   - ___ ___ g. % TS for samples to be reported on a Dry Wt.

III. Data Documentation

Analyst Reviewer

1. ___ ___ The instrument and current conditions must be clearly documented. The Temperature of the Water Bath must be 95°C.
2. ___ ___ **All** Percent Recoveries and RPD's need to be documented in the raw data.
3. ___ ___ If the CCB/PB and/or CCV/LCS are outside of the control limits, **a CAR must be written** and the Section Manager or Unit Leader must be notified that redigestion is required.

III. Data Documentation (continued)

Analyst Reviewer

4. Matrix Spike outside the control limits:
   a. **CLP QC**: No corrective action required, the sample is ticked appropriately.
   b. **Std. QC**: **A CAR must be written** and the Section Manager or Unit Leader must make the decision as to whether re-digestion is required.
   c. If MSA is performed; check the calculation.
5. Sample Duplicate outside the control limits:
   ___ ___ a. **CLP QC:** Normally no corrective action required, and the result is ticked appropriately.
   ___ ___ b. **Std. QC: A CAR must be written** and the Section Manager or Unit Leader must make the decision as to whether redigestion is required.
6. ___ ___ The sample data and QC is recorded in the databook in the order in which they were analyzed. **All** unused data is clearly identified.
7. ___ ___ Standard Traceability is correctly documented.
8. ___ ___ Data Report accurately reflects the documentation in the Databook and the LIMS Spreadsheet.
9. The analyst's full signature is required on the following:
   ___ ___ a. Instrument Data Report
   ___ ___ b. Databook
   ___ ___ c. Data Review Checklist
   ___ ___ d. Print out LabNet Pages, Raw Data, QC, and RunLog
   ___ ___ e. Samples needing copying are clearly marked
10. ___ ___ All unused portions of the data page are Z'd out.
11. ___ ___ Proper Corrective Action Documentation for any out of control situation is clearly identified.

IV. Miscellaneous

Analyst Reviewer

___ ___ 1. Is Sample Prep Linked?
___ ___ 2. Is TCLP Linked? (Shift F9 from the start page)
___ ___ 3. Did all dilutions carry over for MD, MS, MSD (where applicable)?
___ ___ 4. Did all prep and analysis matrices match up?

Comments: ____

Analyst Signature: ______________________________ Date: ____________.

Reviewer Signature: ______________________________ Date: ____________.

SOP No.	Revision No.	Date	Page
UME-6010B	06	01/05/05	1 of 25

TITLE: **Metals Analysis**
Trace Inductively Coupled Argon Plasma by SW-846 6010B (Simultaneous Operation)

Updated by:	Signature:	Date:
Todd D. Smith Senior Analyst	[signature]	1-4-05

Approved by:	Signature:	Date:
Jodi L. Gromala Supervisor, Metals Dept.	Jodi Gromala	1-4-05
David W. Mazur Env. Health & Safety Coor.	[signature]	1-5-05
Terese A. Preston Quality Manager	Terese A. Preston	1/5/05

CONTROLLED DISTRIBUTION

COPY # : Uncontrolled

ISSUED TO :

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

1.0 SCOPE / APPLICATION

This Standard Operating Procedure (SOP) outlines the guidelines for determining metal concentrations by Trace Inductively Coupled Argon Plasma (ICAP) Emission Spectrometry - Simultaneous Operation. This SOP was written using U.S. EPA SW-846 "Test Methods for Evaluating Solid Waste", Third Edition, Method 6010B as a reference.

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP), authorized via laboratory signature approval, and mentioned in the data package's case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually.

1.1.2 Instrument Detection Limits

Instrument Detection Limits (IDLs) are performed on a quarterly basis for each element and for each instrument (as specified in CLP). These limits are used to gauge instrument sensitivity and when routinely evaluated, instrument performance without the introduction of method variance can be determined.

1.1.3 Reporting Limits

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. The laboratory maintains reporting limits that are higher than the MDL. Wherever possible, reporting is limited to values ~3-5x the respective MDL to ensure confidence in the value reported. Client specific requests for reporting to the MDL are special circumstances not to be confused with the previous statement. Refer to Table 1 for element wavelength and reporting limits.

1.1.4 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM).

1.2 Summary of Method

ICAP is a technique for the analysis of soluble or digested samples for metal concentrations using atomic emission spectrometry. All matrices, including water, TCLP extracts, wastes, soils, sludges and sediments, require digestion prior to analysis. The instrument is capable of analyzing simultaneously 29 different elements on a sample.

2.0 INTERFERENCES

Spectral, Physical and Chemical Interferences are the three main interferences that are commonly present on the ICAP.

2.1 Spectral Interferences

Mainly caused by continuous background wavelength, stray light from a high concentration element or overlap of a spectral line from another element. The ICAP can correct for the first two types of interferences by using background correction adjacent to the wavelength. Spectral overlap can be corrected by monitoring the interfering wavelength and computer correcting the results for the false concentration. The values used to correct are known as Inter-Element Correction Factors or IEC's.

2.2 Physical Interferences

Usually associated with the sample uptake and nebulization processes. These interferences can usually be eliminated by using a peristaltic pump which assures a constant sample uptake rate. If a sample is extremely viscous or contains a very high dissolved solids concentration, a dilution of the sample may be required to assure a constant and smooth nebulization rate.

2.3 Chemical Interferences

Normally not significant on the ICAP. These interferences include ionization effects and molecular compound formation. Chemical interferences are highly dependent on the sample matrix type and the element.

Trace ICP can have some ionization effects caused by torch positioning. To eliminate these effects, Cesium is added to the internal standard solution (100 mLs / 1-Liter).
Most interferences can be corrected by ensuring a constant sample uptake rate and by using the correcting abilities of the computer. If severe interferences are suspected, an alternate method such as Graphite Furnace Atomic Absorption (GFAA) can be used or to verify the ICAP results.

3.0 SAFETY

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

3.1 Specific Safety Concerns or Requirements

- The ICP plasma emits strong UV light and is harmful to vision. All analysts must avoid looking directly at the plasma.
- Parts of the instrument can be extremely hot. Care should be taken if the instrument needs to be adjusted internally.
- Proper ventilation is required due to sample fumes and extreme heat generation (RF generator and plasma) and plasma emissions. People with medical conditions that may respond to ozone emissions should exercise caution.

3.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and Symptoms of Exposure
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

Material (1)	Hazards	Exposure Limit (2)	Signs and Symptoms of Exposure
Hydrochloric Acid	Corrosive Poison	5 ppm-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
1 – Always add acid to water to prevent violent reactions. 2 – Exposure limit refers to the OSHA regulatory exposure limit.			

4.0 EQUIPMENT AND SUPPLIES

4.1 Instrumentation

3 - Thermo Jarrell Ash ICAP 61E Trace Analyzer. These instruments are simultaneous ICAP's which currently have 31 analytical wavelengths. Additional wavelengths may be added as required.

The instruments are operated via desktop computers and Thermo Jarrell Ash software (Version 6.2). They also come equipped with a peristaltic pump for sample uptake and an autosampler.

4.2 Supplies

- Volumetric Flasks (Class A): 100 mLs; 200 mLs; 1000 mLs
- Eppendorf Pipettes, varying volumes

5.0 REAGENTS AND STANDARDS

5.1 Reagents

- Milli-Q Water
- *Concentrated Nitric Acid (HNO_3) - InstraPure
- *Concentrated Hydrochloric Acid (HCl) - InstraPure

*Purchased from a vendor.

5.2 Standards and QC Solutions

All stock standards and QC solutions are purchased from an outside supplier in aqueous form. Two types of standards are used: single element and custom mixed standards. Single element standards are available for most elements at a 1,000 mg/L concentration. The shelf life of all purchased solutions are as stated by the manufacturer and are listed in LabNet (LIMS).

5.2.1 Calibration Standards

Prepared with Milli-Q water that has been acidified with 1% HNO_3 and 5% HCl. The calibration standards are prepared daily as follows:

A. Calibration Blank

Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. Repipette 10 mLs conc. HNO_3 and 50 mLs conc. HCl into the flask. Dilute to volume with Milli-Q water and mix thoroughly.

B. Calibration Standards (Refer to Attachment 1 for element concentrations)

Standard	Preparation
S1	• Add ~50 mLs of Milli-Q water to a 200 mL Class A volumetric flask. • Re-pipette 2 mLs conc. HNO_3 into the flask. • Re-pipette 10 mLs conc. HCl into the flask. • Using Eppendorf pipettes, add 2.0 mLs each of: RFW-ICPT-STD-1B RFW-ICPT-STD-1C RFW-ICPT-STD-1D • Dilute to volume with Milli-Q water and mix thoroughly.
S1A	• Add ~50 mLs of Milli-Q water to a 200 mL Class A volumetric flask. • Re-pipette 2 mLs conc. HNO_3 into the flask. • Re-pipette 10 mLs conc. HCl into the flask. • Using Eppendorf pipettes, add 0.8 mLs each of: RFW-ICPT-STD-1B RFW-ICPT-STD-1C RFW-ICPT-STD-1D • Dilute to volume with Milli-Q water and mix thoroughly.
S1B	• Add ~50 mLs of Milli-Q water to a 200 mL Class A volumetric flask. • Re-pipette 2 mLs conc. HNO_3 into the flask. • Re-pipette 10 mLs conc. HCl into the flask. • Using Eppendorf pipettes, add 1.0 mLs each of RFW-ICPT-STD-1B RFW-ICPT-STD-1C RFW-ICPT-STD-1D • Dilute to volume with Milli-Q water and mix thoroughly.
S2	• Add ~50 mLs of Milli-Q water to a 200 mL Class A volumetric flask. • Re-pipette 2 mLs conc. HNO_3 into the flask. • Re-pipette 10 mLs conc. HCl into the flask. • Using Eppendorf pipettes, add 2.0 mLs each of: RFW-ICPT-STD-2A RFW-ICPT-STD-2B RFW-ICPT-STD-3 • Dilute to volume with Milli-Q water and mix thoroughly.

Standard	Preparation
S2A	• Add ~50 mLs of Milli-Q water to a 200 mL Class A volumetric flask. • Re-pipette 2 mLs conc. HNO_3 into the flask. • Re-pipette 10 mLs conc. HCl into the flask. • Using Eppendorf pipettes, add 0.8 mLs each of: RFW-ICPT-STD-2A RFW-ICPT-STD-2B RFW-ICPT-STD-3. • Dilute to volume with Milli-Q water and mix thoroughly.
S2B	• Add ~50 mLs of Milli-Q water to a 200 mL Class A volumetric flask. • Re-pipette 2 mLs conc. HNO_3 into the flask. • Re-pipette 10 mLs conc. HCl into the flask. • Using Eppendorf pipettes, add 1.0 mL each of: RFW-ICPT-STD-2A RFW-ICPT-STD-2B RFW-ICPT-STD-3 • Dilute to volume with Milli-Q water and mix thoroughly.

5.2.2 QC Solutions (Refer to Attachment 2 for element concentrations.)

Prepared with Milli-Q water that has been acidified with 1% HNO_3 and 5% HCl. All QC Solutions are recorded in the intermediate standard traceability logbook.

QC Solution	Preparation (In a 1-L Class A volumetric flask filled w/ ~500 mLs of Milli-Q water, add the following for each QC Solution):
Initial Calibration Verification (ICV)	• 10 mLs conc. HNO_3 • 50 mLs conc. HCl. • 8 mLs of CCV Soln. A • 8 mLs of CCV Soln. A1 • 8 mLs CCV Soln. B • 1.84 mLs of 10,000 ug/mL Ca • 1.6 mLs of 10,000 ug/mL Na, Fe • 1.68 mLs of 10,000 ug/mL Mg • 3.6 mLs of 10,000 ug/mL K, Al • Dilute to volume with Milli-Q water and mix thoroughly.
Continuing Calibration Verification (CCV)	• 10 mLs conc. HNO_3 • 50 mLs conc. HCl. • 10 mLs of CCV Soln. A • 10 mLs of CCV Soln. A1 • 10 mLs of CCV Soln. B • 2.3 mLs of 10,000 ug/mL Ca • 2.0 mLs of 10,000 ug/mL Na, Fe • 2.1 mLs of 10,000 ug/mL Mg • 4.5 mLs of 10,000 ug/mL K, Al • Dilute to volume with Milli-Q water and mix thoroughly.

QC Solution	Preparation (In a 1-L Class A volumetric flask filled w/ ~500 mLs of Milli-Q water, add the following for each QC Solution):
CRI [Contract Required Detection Limit (CRDL) Standard for ICAP]	• 10 mLs conc. HNO_3 • 50 mLs conc. HCl • 40 uLs of Cd Intermediate Std.* • 80 uLs of Be Intermediate Std. * • 10 uLs of 10,000 ug/mL Fe • 10 uLs of 1,000 ug/mL Co, Se, Ag, Sr, Ti, V, Pb • 20 uLs of 10,000 ug/mL Ca, Mg • 20 uLs of 1,000 ug/mL As, Cu, Cr, Mn, Ni, Ba, Mo, Tl, Zn • 40 uLs of 10,000 ug/mL Al • 40 uLs of 1,000 ug/mL Sb, Sn • 200 uLs of 10,000 ug/mL Na • 100 uLs of 10,000 ug/mL K • 100 uLs of 1,000 ug/mL B, Bi • 400 uLs of 1,000 ug/mL Si • Dilute to volume with Mill-Q water and mix thoroughly. * Cd Intermediate = 1:10 dilution of 1,000 ppm Cd. * Be Intermediate = 1:10 dilution of 1,000 ppm Be
Interferent Check Standard (ICSA)	• 10 mLs conc. HNO_3 • 50 mLs conc. HCl • 100 mLs of CLP Interferent A Solution • Dilute to volume with Milli-Q water and mix thoroughly
Interferent Check Standard (ICSAB)	• 10 mLs conc. HNO_3 • 50 mLs conc. HCl • 100 mLs of CLP Interferent A Solution • 10 mLs of CLPP-ICS-B4 • Dilute to volume with Milli-Q water and mix thoroughly.

6.0 CALIBRATION (NON-DAILY)

6.1 Linear Range Analysis Standard (LRS)

LRS calibration is performed quarterly that covers the anticipated range of measurement. The expected recovery limit for this verification standard is 95-105%. This is used to verify linearity and document the upper limit of the calibration range for each element. At least one of the calibration standards will be at or near the reporting limit. The calibration curve generated must have a correlation coefficient of $\geq$ 0.995 in order to consider the responses linear over that range. All samples found to be above the ICAP linear range are diluted and re-analyzed until the concentration falls within the instruments linear range.

6.2 Inter-Element Correction (IEC)

Correction factors for spectral interference due to Al, Ca, Fe, and Mg will be determined at least annually for all wavelengths used for each analyte reported or any time the ICAP is adjusted in any way that may affect the IECs. Correction factors for spectral interferences other than Al, Ca, Fe, and Mg are recommended and are performed as needed and documented with the instrument records.

7.0 PROCEDURE

7.1 Quality Control Checks

The following section summarize the quality control (QC) samples associated with ICAP analysis.

QC Sample	Frequency	Control Limit [1]
Method Blank (MB)	1 per 20 samples	$\leq$ Reporting Limit
Lab Control Sample (LCS) [2]	1 per 20 samples	80 – 120 %
Matrix Spike (MS) [3,6]	1 per 20 samples	75 – 125 %
MS Duplicate (MSD) [3,6]	1 per 20 samples	75 – 125 %; 20 RPD
Duplicates (MD) [4,6]	1 per 20 samples	20 RPD
Serial Dilution (5x) [5]	1 per 20 samples	$\pm$ 10% of the original result

[1] Refer to Section 8 for additional details.
[2] LCS Duplicate (LCD) is performed only when required by the client or project.
[3] If sample concentration is $\leq$ 4X spike level, 75-125%; if sample concentration is > 4X spike level, no control range. If TCLP matrix spike is < 50%, Standard Addition must be performed.
[4] If $\geq$ 5X reporting limit, 20 RPD; if < 5X reporting limit $\pm$ reporting limit; if < reporting limit no control range.
[5] If the analyte concentration is >10X the MDL, results should agree within $\pm$10% of the original sample result.
[6] The sample selection for matrix QC, if not specified by the client or on the chain-of-custody, is rotated among client samples so that various matrix problems may be noted and/or addressed...pre-determined by the digestion department.

7.2 Sample Preservation and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Holding Time[1]	Preservation	Reference
Waters	180 days	HNO_3, pH < 2; Cool 4 $\pm$ 2°C	40 CFR Part 136.3
Soils	180 days	Cool 4 $\pm$ 2°C	N/A

[1] Inclusive of digestion and analysis.

7.3 Sample Preparation

The most commonly used digestion procedures are SW-846 Methods 3010A (waters) and 3050B (soils). Refer to USP-3000 for details on sample digestion. The samples are received in the metals laboratory as 25, 50 or 100 mL final volumes.

7.4 Calibration / Standardization

7.4.1 Instrument Set Up

Set up the instrument with the proper operating conditions as defined in the TJA instrument manual. The instrument must be allowed to become thermally stable (~1-hour) prior to profiling and calibration. The instrument is profiled using a 1-ppm Arsenic standard (S1) by aspiration and selecting the automatic profile feature from the TJA software. The peak position reading should be within +/- 0.1. If the reading is acceptable, record the peak area in the logbook & rinse. If the reading is > +/- 0.1, set the micrometer to the adjusted vernier position given by the instrument and profile again to verify. Record the peak area in the logbook and rinse. The instrument is now ready to calibrate.

7.4.2 Standardization

Before any instrument is used as a measurement device, the instrument response to known reference materials must be determined. All sample measurements must be made within the linear range of the instrument.

The instrument is standardized using a calibration blank and 3 calibration standards, which consist of 6 multi-element solutions. The results are given in intensities. Minimum requirement is a blank and a standard.

Standard	Frequency	Control Limit
Calibration Curve	Initially	Corr. Coeff. $\geq$ 0.995
High Standards (S1, S2)	After the Calibration Curve	$\pm$ 5% of the Known Conc.
Initial Cal. Verif. (ICV)	After the Calibration Curve	$\pm$ 10% of the Known Conc.
Initial. Cal. Blank (ICB)	After the ICV	$\leq$ Reporting Limit
CRI	Daily, every 8 hrs. thereafter	None Required
ICSA / ICSB	Daily, every 8 hrs. thereafter	$\pm$ 20% of the Known Conc.
Cont. Cal. Verif. (CCV)	Every 10 reading; End of each run	$\pm$ 10% of the Known Conc.

Standard	Frequency	Control Limit
Cont. Cal. Blank (CCB)	Every 10 readings; End of each run	≤ Reporting Limit

7.5 Preventive Maintenance

The required preventive maintenance is listed in the preventive maintenance logbooks which are kept at the instruments. All maintenance is recorded in these logbooks along with the date and the signature of the analyst performing the maintenance. The instruments are under a full service contract with the manufacturer for all major repairs.

7.5.1 Daily Maintenance

Includes changing the pump tubing for consistent sample uptake and a visible check of the waste container to make sure that it doesn't overflow.

7.5.2 Weekly Maintenance

Includes checking the air filters on the back of the instrument for excessive dust buildup, and checking the tip of the torch for excessive buildup of material.

7.5.3 Monthly Maintenance

Includes cleaning and checking the water re-circulator for proper fluid level, cleaning the spray chamber.

7.6 Sample Analysis

7.6.1 Analytical Run

After the instrument is standardized (Section 7.4.2), an analytical run is initiated. The first run of the day would proceed as follows:

- S1,S2 — Reanalysis of calibration standard as a sample
- ICV — Initial Calibration Verification
- ICB — Initial Calibration Blank
- CRI — Spiked Blank Sample
- ICSA — Interferent Check Standard A
- ICSB — Interferent Check Standard B
- CCV — Continuing Calibration Verification
- CCB — Continuing Calibration Blank
- MB (1) — Method Blank
- LCS (2) — Laboratory Control Sample
- Sample (3)
- Sample (4) — Serial Dilution (L)

- Sample (5) Matrix Duplicate (MD)
- Sample (6) Matrix Spike (MS)
- Sample (7) Matrix Spike Duplicate (MSD)
- Sample (8)
- .
- Sample X (10)
- CCV Continuing Calibration Verification
- CCB Continuing Calibration Blank

If the CCV and CCB results are acceptable, the run may continue without restandardization. If any of the post-run QC is out of control, or close to being out of control, the instrument is restandardized before analyzing the next batch. Any samples with elements associated with an out of control CCV or CCB will be reanalyzed.

7.7 Documentation

7.7.1 Instrument Run-Log

The analysis of samples and standards is documented within the instrument run log (Attachment C), which must be for each days analysis, and is supported by the instrument print-out.

7.7.2 Traceability of Standards

Custom made and single element stock standard solution which are traceable to NIST or EPA are purchased. Upon receipt, each standard is entered into LabNet and is issued a unique source ID#. The manufacturer, lot #, date received, expiration date, date of verification and the initials of the recording analyst are also entered.

7.7.3 Data Review

Analytical data goes through a 200% review cycle. The analyst and a trained data reviewer perform the reviews according to the criteria established on the data review checklist (Attachment D). Upon the first 100% review, the checklist is initialed and dated as reviewed. The package, with its review sheet, comments and any Corrective Action Reports (CARs) are submitted to the supervisor or peer reviewer for a second review. Once again, the checklist is initialed and dated by the second reviewer. The completed data review form remains on file with the original data.

8.0 QUALITY CONTROL

8.1 QC Summary

NOTE: The following laboratory acceptance criteria are set at default control limits. Statistical limits are generated on an annual basis from cumulative LCS data and can be implemented when specified by the client, contract, or QAP.

8.1.1 Method Blank (MB)

At least one MB and one LCS will be included in each digestion batch of 20 samples. Regardless of the matrix being processed, the LCS and MB will be in an aqueous media. The MBs are analyzed to determine if contaminants are being introduced into the sample via the sample preparation procedures.

8.1.2 Laboratory Control Sample (LCS)

The LCS is analyzed to determine the accuracy of the digestion process.

Accuracy will be measured by the percent recovery (%R) of the LCS. The recovery must be within ±20% of the known concentration. If the LCS results are outside these control limits, all samples in the preparation set must be redigested and reanalyzed. Refer to Attachment E for element concentrations.

8.1.3 Matrix Duplicate (MD)

A duplicate sample will be prepared at a frequency of 5% (1 in 20 samples). A 20 RPD is set as the acceptance limits.

8.1.4 Matrix Spike (MS) / Matrix Spike Duplicate (MSD)

The MS / MSD will be prepared at a frequency of 5% (1 in 20 samples). The recovery must be within 75–125%. (Exception allowed if the sample concentration exceeds 4 times the spike added concentration.)

TCLP - If the MS recovery is <50% and the concentration does not exceed the regulatory limit or the sample concentration is within 20% of the regulation level, the Method of Standard Addition (MSA) is required. Three aliquots of the sample are spiked at 50%, 100% and 150% of the sample concentration or, if the sample concentration is < RL, the MSA is at 50%, 100% and 150% of the MS level. The data is subjected to linear regression whereas the concentration of the unknown is the x-intercept and the correlation coefficient value must be ≥ 0.995.

8.1.5 Serial Dilution

A Serial Dilution (5X) will be prepared from the digestate at a frequency of 5% (1 in 20 samples). If the concentration is >50 times the MDL, results should agree within +/- 10% of the original results.

8.2 Corrective Action

When an out-of-control situation occurs, the analysts must use his/her best analytical judgment and available resources to determine the corrective action to be taken. The out-of-control situation may be caused by more than one variable. The analyst should seek the assistance of his/her supervisor, QA personnel, or other experienced staff if he/she are uncertain of the cause of the out-of-control situation. The analysis must not be resumed until the source of the problem and an in-control status is attained. All samples associated with the out-of-control situation should be reanalyzed. Out-of-control data must never be released without approval of the supervisor, or QA personnel.

The following steps that must be taken when an out-of-control situation occurs:

- demonstrate that all the problems creating the out-of-control situation were addressed;
- document the problem and the action which was taken to correct the problem on a CAR;
- document on the CAR that an in-control has been achieved; and
- receive approval (signature) of the supervisor or QA personnel prior to the release of any analytical data associated with the problem.

QC Indicator	Suggested Corrective Actions
Calibration Curve	• reanalyze the standard curve; • prepare a new stock and/or working standards; • check the reagents/solutions and prepare fresh if necessary.
ICV	• repeat the ICV to verify proper preparation; • prepare a new ICV from original stock; • recalibrate with a new standard curve; • prepare a new stock and/or working standards; • check the reagents/solutions and prepare fresh if necessary.
ICB	• prepare a new ICB to verify proper preparation; • verify that the instrument base-line is stable and perform necessary maintenance, cleaning, etc.. to achieve stability; • determine the source of contamination by process of elimination, carryover from a previous analysis or reagent contamination and correct the problem; • check the reagents/solutions and prepare fresh if necessary; • correct for any contamination and reanalyze the ICB and any associated samples.

QC Indicator	Suggested Corrective Actions
LCS	If the LCS is low: • reanalyze the LCS and all samples in the set for the failed analyte(s) to confirm that it is out of control. • If continued out of control, redigest and reanalyze the set. • Write a CAR. If the LCS is high: • reanalyze the LCS and all samples in the set for the failed analyte(s) to confirm that it is out of control. • check for contamination of reagents, LCS stock solution, or in the preparation area; • correct for contamination, redigest and re-analyze the set; • Write a CAR.
MB	• reanalyze the MB to verify that it is beyond the reporting limit; • determine the source of contamination; • determine if a high value is due to contamination; • check for contamination of reagents or in the preparation area; • correct for contamination, reanalyze the set; • in the extreme case where all samples in the set are at least 10x > the MB or < RL, reanalysis will not be required; however, a CAR will be written and approved by the supervisor or section manager.
MD	• a CAR will be written and approved by the supervisor or section manager.
MS / MSD	• a CAR will be written and approved by the supervisor or section manager.
Serial Dilution (L)	• prepare a new serial dilution to verify proper preparation; • a CAR will be written and approved by the supervisor or section manager.
CCV	• repeat the CCV to verify proper preparation; • prepare a new CCV from the original stock; • check for instrument base-line drift or a change in one or more of the reagents; • check the reagents/solutions and prepare fresh if necessary; • recalibrate with a new standard curve and repeat all samples since the previous in control CCV; • never dispose of any samples until you are sure that all QC are within the control limits.
CCB	• check reagents/solutions to verify proper preparation and prepare fresh if necessary; • verify that the instrument base-line is stable and/or perform necessary maintenance, cleaning, etc., to achieve stability; • correct for any contamination (carryover from a previous analysis or reagent contamination) and reanalyze the CCB and any associated samples; • never dispose of any samples until you are sure that all QC are within the control limits.

QC Indicator	Suggested Corrective Actions
Additional CAs	• If any of the ICV, ICB, ISA, ISB, CCV or CCB results are out-of-control for any element, the instrument is restandardized and the samples associated with the out-of-control elements are reanalyzed. • If the MB or LCS are out of control for any element, the samples are redigested. An exception is if the sample concentrations are $\geq$ 10X the MB contamination or < RL. In this case, the results are reported as is. • If any of the MD or MS/MSD results are out of control, the client is notified of the poor results via a case narrative that is sent with the data report. • CARs are completed by the analyst performing the analysis. The forms are then reviewed and signed by the supervisor or section manager. The signed forms are filed with the original data and a copy is kept on file in the Metals Department.

9.0 DATA ANALYSIS AND CALCULATIONS

The sample results are stored in a data file on the desktop computer. The data is transferred over to LabNet and edited there. This system helps to eliminate transcription errors, since data is not entered by hand.

9.1 Accuracy

9.1.1 ICV / CCV, LCS % Recovery

$$\text{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{known concentration}} \times 100$$

9.1.2 MS / MSD % Recovery

$$\text{MS / MSD \% Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$$

9.2 Precision (RPD)

9.2.1 Matrix Duplicate (MD)

$$\text{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

9.3 Concentration

$$\text{mg/kg or L} = \frac{C \times V \times D}{W}$$

Where:
C = sample concentration in extract (ppm)
V = Volume of extract (mL)
D = Dilution Factor
W = Weight/Volume of sample aliquot extracted (grams or mLs)

NOTE: All dry weight corrections are made in LabNet at the time the final report is prepared.

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

10.1 Waste Streams Produced by the Method

The following waste streams are produced when this method is carried out.

- Waste from this procedure will enter the "Corrosive Wastewater" wastestream.

11.0 METHOD PERFORMANCE CRITERIA

Refer to Sections 1.0, 7.0 and 8.0.

12.0 REFERENCES

Refer to Section 1.0.

13.0 ATTACHMENTS

Table 1. Element and Reporting Limits
Attachment 1. Standard Stock Solutions
Attachment 2. Stock QC Solutions
Attachment 3. Example: Analysis Run Log / Maintenance Log
Attachment 4. Example: Data Review Form
Attachment 5. Known Digested Quality Control

Historical File:

Revision 00: 02/11/98
Revision 01: 01/29/99
Revision 02: 03/20/00
Revision 03: 06/29/01
Revision 04: 09/13/02
Revision 05: 10/30/03
Revision 06: 01/03/05

Reasons for Revision; Revision 06:

- Annual Review – Maintenance Log added as attachment.

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Table 1.

Element and Reporting Limits

Element	ICAP 61E (ICP3) Wavelength (nm)	ICAP 61E (ICP4) Wavelength (nm)	ICAP 61E (ICP5) Wavelength (nm)	Reporting Limits[1] Waters (mg/L)	Soils (mg/kg)
Al	308.2	308.2	308.2	0.2	20
Sb	206.8	206.8	206.8	0.02	2
As	189.0	189.0	189.0	0.01	1
Ba	493.4	493.4	493.4	0.01	1
Be	313.0	313.0	313.0	0.004	0.4
Bi	223.0	223.0	N/A	0.05	5
B	249.6	249.6	249.6	0.05	5
Ca	317.9	317.9	317.9	0.1	10
Cd	226.5	226.5	226.5	0.002	0.2
Cr	267.7	267.7	267.7	0.01	1
Co	228.6	228.6	228.6	0.005	0.5
Cu	324.7	324.7	324.7	0.01	1
Fe	271.4	271.4	271.4	0.05	5
Pb	220.3	220.3	220.3	0.005	0.5
Mg	279.0	279.0	279.0	0.1	10
Mn	257.6	257.6	257.6	0.01	1.0
Mo	202.0	202.0	202.0	0.01	1
Ni	231.6	231.6	231.6	0.01	1
K	766.4	766.4 / 404.7	766.4	0.5 / 10	50 / 1,000
Se	196.0	196.0	196.0	0.01	1
Si	288.1	288.1	288.1	0.2	20
Ag	328.0	328.0	328.0	0.005	0.5
Na	330.2	330.2	330.2 / 588.9	1	100
Sr	421.5	NA	421.5	0.005	0.5
Tl	190.8	190.8	190.8	0.01	1
Sn	189.9	189.9	189.9	0.02	2
Ti	334.9	337.2	334.9	0.005	0.5
V	292.4	292.4	292.4	0.005	0.5
Y[2]	371.0	371.0	371.0	N/A	N/A
Zn	213.8	206.2	206.2	0.02	2

[1]These are routine Trace ICAP reporting limits (RL). Lower RLs are available and can be used per client request. RLs will vary depending on sample size/volume, dilution factors, dry weight reporting for soils, and changes in MDLs.
[2]Y is used as an internal standard and is introduced continuously to all samples (including standards and QC samples) via the peristaltic pump at an approximate concentration of 5 ppm.

Attachment 1.

Standard Stock Solutions

Vendor	Stock Name	Element	Conc. (mg/L)	S1A	S1B	S1	S2A	S2B	S2
Inorganic Ventures	RFW-ICPT-STD-1B	Sb	100	0.4	0.5	1			
		Mo	100	0.4	0.5	1			
		Si	100	0.4	0.5	1			
		Sn	100	0.4	0.5	1			
		Ti	100	0.4	0.5	1			
Inorganic Ventures	RFW-ICPT-STD-1C	Al	1,000	4	5	10			
		Fe	1,000	4	5	10			
		K	1,000	4	5	10			
		Na	1,000	4	5	10			
		Li	800	2	4	8			
		Mg	800	2	4	8			
		Ca	400	1.6	2	4			
Inorganic Ventures	RFW-ICPT-STD-1D	As	100	0.4	0.5	1			
		Ba	100	0.4	0.5	1			
		Be	100	0.4	0.5	1			
		Bi	100	0.4	0.5	1			
		B	100	0.4	0.5	1			
		Cd	100	0.4	0.5	1			
		Cr	100	0.4	0.5	1			
		Cu	100	0.4	0.5	1			
		Pb	100	0.4	0.5	1			
		Ni	100	0.4	0.5	1			
		Se	100	0.4	0.5	1			
		Ag	100	0.4	0.5	1			
		Sr	100	0.4	0.5	1			
		Tl	100	0.4	0.5	1			
		Zn	100	0.4	0.5	1			
Inorganic Ventures	RFW-ICPT-STD-2A	Al	10,000				40	50	100
		K	10,000				40	50	100
Inorganic Ventures	RFW-ICPT-STD-2B	Ca	5,000				20	25	50
		Fe	5,000				20	25	50
		Mg	5,000				20	25	50
		Na	5,000				20	25	50
Inorganic Ventures	RFW-ICPT-STD-3	Pb	2,000				8	10	20
		Mn	1,000				4	5	10
		V	1,000				4	5	10

Attachment 2.

Example of Stock QC Solutions

Vendor	Stock Name	Element	Conc. (mg/L)	ICV (mg/L)	CCV (mg/L)
High Purity	CCV Solution A	As	50	0.4	0.5
		B	50	0.4	0.5
		Ba	50	0.4	0.5
		Be	50	0.4	0.5
		Bi	50	0.4	0.5
		Cd	50	0.4	0.5
		Co	50	0.4	0.5
		Cr	50	0.4	0.5
		Cu	50	0.4	0.5
		Ni	50	0.4	0.5
		Pb	50	0.4	0.5
		Se	50	0.4	0.5
		Fe	500	20	25
		Mn	500	4	5
		V	500	4	5
		Tl	50	0.4	0.5
		Zn	50	0.4	0.5
		Sr	50	0.4	0.5
High Purity	CCV Solution A2	Ca	200	20	25
		Li	400	---	---
		Na	500	20	25
		Al	500	40	50
		Mg	400	20	25
		K	500	40	50
High Purity	CCV Solution B	Ag	50	0.4	0.5
		Sb	50	0.4	0.5
		Mo	50	0.4	0.5
		Si	50	0.4	0.5
		Sn	50	0.4	0.5
		Ti	50	0.4	0.5
Ultra	Single Elements * spiked on top of custom mixes.	Al	10,000	40	50
		Ca	10,000	20	25
		Fe	10,000	20	25
		Na	10,000	20	25
		K	10,000	40	50
		Mg	10,000	20	25

Attachment 2.
(continued)
Examples of Stock QC Solutions

Vendor	Stock Name	Element	Conc. (mg/L)	CRI Conc. (mg/L)
Inorganic Ventures	Beryllium	Be	1,000	0.008
	Chromium	Cr	1,000	0.02
	Cobalt	Co	1,000	0.01
	Copper	Cu	1,000	0.02
	Manganese	Mn	1,000	0.02
	Nickel	Ni	1,000	0.02
	Silver	Ag	1,000	0.01
	Vanadium	V	1,000	0.01
	Zinc	Zn	1,000	0.02
	Antimony	Sb	1,000	0.04
	Arsenic	As	1,000	0.02
	Cadmium	Cd	1,000	0.004
	Lead	Pb	1,000	0.01
	Selenium	Se	1,000	0.01
	Thallium	Tl	1,000	0.02
Inorganic Ventures	Calcium	Ca	10,000	0.2
	Potassium	K	10,000	1.0
	Magnesium	Mg	10,000	0.2
	Sodium	Na	10,000	2.0
	Iron	Fe	10,000	0.1
	Aluminum	Al	10,000	0.04
	Barium	Ba	1,000	0.02
	Boron	B	1,000	0.1
	Bismuth	Bi	1,000	0.1
	Molybdenum	Mo	1,000	0.02
	Silicon	Si	1,000	0.4
	Tin	Sn	1,000	0.04
	Strontium	Sr	1,000	0.01
	Titanium	Ti	1,000	0.01

Attachment 2.
(continued)
Stock QC Solutions

Vendor	Stock Name	Element	Conc. (mg/L)	ICSA Conc. (mg/L)
Inorganic Ventures	CLP Interferents "A" Solution	Al	5,000	500
		Ca	5,000	500
		Mg	5,000	500
		Fe	2,000	200
				ICSB Conc. (mg/L)
Inorganic Ventures	CLP Interferent A Solution	Al	5,000	500
		Ca	5,000	500
		Mg	5,000	500
		Fe	2,000	200
Inorganic Ventures	CLPP-ICS-B4	Cd	100	1
		Ni	100	1
		Zn	100	1
		Sb	60	0.6
		Ba	50	0.5
		Be	50	0.5
		Co	50	0.5
		Cr	50	0.5
		Cu	50	0.5
		Mn	50	0.5
		V	50	0.5
		Ag	20	0.2
		As, Tl	10	0.1
		Pb, Se	5	0.05

Attachment 3.

Example: Analysis Runlog / Maintenance Log

STL Chicago
TJA Trace ICAP (61E) Analysis Log – ICP3

Page No.______________

Date	Initials	File Name	Dig. Set	Int. Std	Sample Nos.	Parameters	Comments
				As =			
				Y =			
				As =			
				Y =			
				As =			
				Y =			
				As =			
				Y =			
				As =			
				Y =			
				As =			
				Y =			
				As =			
				Y =			
				As =			
				Y =			
				As =			
				Y =			

Reviewed by:______________________________ Date:____________________

STL Chicago
TJA Trace ICAP (61E) - ICP3
Instrument Maintenance Log

Page No.____________

	Date/Initials	Date/Initials	Date/Initials	Date/Initials	Date/Initials	Date/Initials	Date/Initials
Daily Maintenance:							
Check/Change Pump Tubing							
Check Waste Container							

Weekly Maintenance:							
Clean Air Filters							
Check Torch for buildup (Note Cleaning)							
Check/Change Printer Ribbon							

Monthly Maintenance:							
Check/Refill Recirculator							
Check Nebulizer/Spray Chamber							

Comments:____

____

____

____

Any Maintenance/Repair/Part Replacement performed that is not listed above must be documented in the Comments sections

Reviewer Signature:______________________________ Date:________________

Attachment 4.

Example: Data Review Checklist

STL Chicago
INORGANIC CLP / LEVEL IV DATA REVIEW CHECKLIST

Site Name: ______________ Primary Reviewer: ______________ Review Date: __________
JOB Number: ______________ Secondary Reviewer: ______________ Review Date: __________
No. of Samples/Matrix: a) WATER ______ b) SOIL ______ c) TCLP / SPLP ______ d) OTHER ______________

Metals List: a) TAL b) PP c) TCLP d) Other (________________________________)
Report Level: **IDL** = a) CLP b) Non-CLP c) MDL d) Other ________ **CRDL** = a) CLP b) Client c) Default RL d) Other ____

TASK : CAR's ______	PRI REV	SEC REV	COMMENTS
LAB CHRON: 1) Matches COC			
2) Proper Prep Links: S-F6 (Routine) S-F9 (TCLP/SPLP)			
3) Sample Hold Times Met			
Cyanide Reported on Forms	Y / N		Method: a) CLP b) SW846 9010B/9014
Initial / Continuing Calibration Criteria Met (CRA/CRI requirements met if applicable)			
FORM 1: Matches Report LabNet Report Units / Test Matrix Match Form 1's Dilutions due to interference's resulted in elevated RL's			
FORM 3: Method Blanks < CRDL			
FORM 5A: MS Recoveries Acceptable Default Limits _____ Statistical Limits _____ Project Limits _____ (S-F10 used to Clone By Project)			N
FORM 5B: PDS Performed			
FORM 6: Duplicate RPD Acceptable Default Limits _____ Statistical Limits _____ Project Limits _____ (S-F10 used to Clone By Project)			*
FORM 7: LCS Recoveries Acceptable Default Limits _____ Statistical Limits ______ Project Limits _____ (S-F10 used to Clone By Project)			^
FORM 8: MSA Analysis Performed			S
GFAA – Analytical Spike (AS) Recoveries Acceptable			W
GFAA – Repeat Analytical Recovery <40%			E
GFAA – Duplicate Injection Precision Met			M
FORM 9: Serial Dilution (SD) Acceptable			E
FORM 14's Correct			
RAW DATA: Complete (Match Batches to LabChron) a) Instr. Raw Data clearly displays the LabNet Batch number and includes the "Batch Worksheet" Report b) Prep Raw Data displays the LabNet Batch Number and includes the "Batch Worksheet" Report or "Raw Data" Report			

Comments on Reverse

TASK : CAR's ______	PRI REV	SEC REV	COMMENTS

LabNet Batch Status Report Displays Data At RVWD Status			
Incomplete JOB Status Report reveals no Outstanding Data			
NARRATIVE: 1) Holding Times			
2) Method References			Method: a) CLP b) SW846 c) Other
3) % Recoveries / RPD's			
4) Analytical Difficulties/Typos			

COMMENTS:

QC CYCLE	REASON
1	
2	

STL Chicago
ICAP Metals Data Review Checklist

Instrument ID: **ICP 3** **ICP 4** **ICP 5** **Filename:**__________________________

Analyst Initial(s):__________________________ **LabNet Batch No.:**____________________

Copies:

****

QC Type: a. CLP b. Standard c. TCLP d. Drinking Waters e. Solubles

I. Calibration:

Analyst	Reviewer	
☐	☐	1. Verification of standard traceability and expiration (daily).
		2. Calibration is clearly documented:
☐	☐	a. Instrument is calibrated using a Blank and three Calibration Standards. The correlation coefficient must be ≥0.995.
☐	☐	b. Reanalysis of the top calibration standard as a sample. Control limits are 95 - 105%. (Run once daily prior to sample analysis).
		3. Calibration Verification: (10% Frequency):
☐	☐	a. ICV/CCV: **Std./CLP** – Recovery 90-110% **EPA 200.7 (ICV) –** Recovery 95-105%
☐	☐	b. ICB/CCB: **Std. QC:** < RL; **CLP QC:** < CRDL; **SW-846 QC:** < 3x MDL. (custom criteria code)
		4. **CLP QC:** An Initial & Final for each sample analysis run:
☐	☐	a. CRI - 2x RL; No Limit Set
☐	☐	b. ISA/ISAB - 80-120% Recovery
		5. **Std. QC:** Analyzed at the beginning of the day and every 8 hours thereafter:
☐	☐	a. CRI: 2x CRDL; No Limit Set
☐	☐	b. ISA/ISAB: 80-120% Recovery
		Refer to Run #:

Note: **CLP QC** requires the use of the IDL for calculating % Recoveries and Reporting Limits.
Standard QC requires the use of the RL for calculating % Recoveries and Reporting Limits.

II. Sample Analysis:

Analyst	Reviewer	
		1. Each Prep Batch consists of a maximum of 20 samples of a similar matrix:
☐	☐	a. Prep Batches must be clearly identified
☐	☐	b. 1 Prep Blank **CLP** - < CRDL; **Std. QC** - < RL **TCLP** - < TCLP Reporting Limit
☐	☐	c. 1 LCS **Std./CLP** - 80-120% Rec.; **EPA 200.7** - 85-115% Rec.
☐	☐	d. 1 Duplicate **Std.** - RPD or RSD limits are 20%; ***Unless*** the sample conc. is <5x RL then ± RL applies; for CLP ± CRDL applies. **EPA 200.7** - 10% Frequency
☐	☐	e. 1 Matrix Spike **Std./CLP** - 75-125% Rec.; ***Unless*** the sample conc. exceeds the spike conc. by 4x; **EPA 200.7** - 70-130% Rec.; 10% Frequency
☐	☐	f. Analytical MS **TCLP** - >50% (MSA performed if <50% recovery)
☐	☐	g. Serial Dilution 1 per 20 samples; 10% Difference Limit
☐	☐	h. A post-digestion spike (PMS) must be performed for CLP (75-125%) and 200.7 (85-115%) if the above limits are not met, (CLP - except for Ag, Na, Ca, K, and Mg for waters and soils, and Al and Fe for soils only).
☐	☐	i. Turbidity Checked: **EPA 200.7 Drinking Water** (< 1 NTU; no prep required).

STL Chicago
ICAP Metals Data Review Checklist

II. Sample Analysis (continued):

Analyst	Reviewer	
		2. A Corrective Action Report (CAR) must be written for any out of control situations, clearly stating the problem and action to be taken:
☐	☐	a. CAR included with original data run
☐	☐	b. CAR with corrective action results included with the corrective action run.

III. Data Documentation

Analyst	Reviewer	
		1. Raw Data:
☐	☐	a. Unused data is clearly identified.
☐	☐	b. All crossed out data is initialed and dated.
☐	☐	c. Out of control QC is clearly identified.
☐	☐	d. Any data that has a tick (S, I, H or L) is commented on with appropriate action taken.
☐	☐	e. The first page of the run must have the filename; instrument; and analyst's signature

Analyst	Reviewer	
		2. Run Log:
☐	☐	a. Unused data is clearly identified.
☐	☐	b. All cross outs are initialed and dated.
☐	☐	c. Analyst's Signature is required.

Analyst	Reviewer	
		3. LabNet:
☐	☐	a. Worksheet and data pages are printed.
☐	☐	b. Unused data is clearly identified.
☐	☐	c. All cross-outs are initialed and dated.
☐	☐	d. First page must have the filename, instrument identification; analyst signature.
☐	☐	e. Samples needing copying are clearly marked.
☐	☐	f. Label Sample ID with the LabNet Batch their in.

III. Miscellaneous

Analyst	Reviewer	
☐	☐	1. Is Sample Prep Linked?
☐	☐	2. Is TCLP Linked? (Shift F9 from the start page)
☐	☐	3. Did all dilutions carry over for MD, MS, MSD (where applicable)?
☐	☐	4. Did all prep and analysis matrices match up?

Comments:

____

____

____

Analyst Signature: ______________________________ Date:

Reviewer Signature: ______________________________ Date:

Attachment 5.

Known Digested QC Values (mg/L)

Element	LCS/Spike	TCLP Spike
Al	2	---
Sb	0.5	---
As	0.1	5
Ba	2	100
Be	0.05	---
Bi	0.5	---
B	1	---
Cd	0.05	1
Ca	10	---
Cr	0.2	5
Co	0.5	---
Cu	0.25	0.25
Fe	1	---
Pb	0.10	5
Mg	10	---
Mn	0.5	---
Mo	1	---
Ni	0.5	0.5
P	0.5	---
K	10	---
Se	0.10	1
Si	5	---
Ag	0.05	1
Na	10	---
Sr	1	---
Tl	0.10	---
Sn	1	---
Ti	1	---
V	0.5	---
Zn	0.5	---

Default Control Limits
LCS: 80 - 120%
Spike: 75 - 125%
TCLP Spike: >50%

SOP No.	Revision No.	Date	Page
UQA-029	08	09/30/04	1 of 15

TITLE: QUALITY ASSURANCE
Sample Discrepancy Reports / Resubmitted Data Reports / Corrective Action Reports (SDR / RDR / CAR)

Reviewed by:	Signature:	Date
Marilyn J. Krueding Quality Assurance Specialist	Marilyn J. Krueding	9/23/04

Approved by:	Signature:	Date
Terese A. Preston Quality Manager	Terese A. Preston	9/22/04

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ISSUED TO : Uncontrolled

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

1.0 Scope / Application

This Standard Operating Procedure (SOP) describes the laboratory process for responding to client complaints, sample-related discrepancies, and analytical non-conformances. The documentation process that is used to address the issue, its resolution, actions taken and final approval are described within this SOP. The documentation mechanism includes the following forms:

1) Sample Discrepancy Report (SDR)
2) Resubmitted Data Request (RDR)
3) Corrective Action Report (CAR).

This SOP provides instructions for the completion of these forms.

2.0 Discussion

The SDR, RDR and CAR are communication vehicles for documenting events within the laboratory and decisions related to those events. This documentation provides the laboratory and client with information in which to recreate the situation and to understand the circumstances that led to its ultimate resolution. Review of these reports can be a diagnostic quality tool for measuring system or process performance.

An SDR is generated prior to the release of data to the client. It is applicable for any sample-related situation noted during sample receipt, sample analysis, and data reporting. The SDR is initiated either by the sample custodian, project manager (PM), data management personnel, section manager (SM), analyst, or Quality Assurance (QA) personnel. All information discrepancies associated with the sample Chain-of-Custody (COC) must be documented with an SDR and/or LabNet Job Note with reference made to the discrepancy on the sample receipt checklist.

The RDR is used after the client has received the analytical report and their specifications, expectations, and/or client satisfaction were not achieved. RDRs are prepared when:

- a client requests re-evaluation of already submitted data
- a client requests additional information originally omitted from data package
- a client complaint requires a formal laboratory response

The RDR is initiated either by the project management (PM) or data management personnel, however, section managers, Quality Assurance (QA) personnel or anyone with direct customer contact can initiate this process. An RDR may also be initiated by the laboratory when an error has been identified internally.

The CAR is prepared prior to the reporting of the data for any quality-related non-conformance to requirements, excluding sample specific situations in which an SDR is completed. The CAR can be initiated by anyone, but is typically initiated by the analyst, section manager, or QA personnel. Typical 'non-conformance to requirements' documented with a CAR are:

- Analytical Quality Control criteria deviation
- Regulatory method deviation
- Laboratory policy or procedure deviation
- Certification/agency program requirement deviation
- Contract deviation

3.0 Sample Discrepancy Report

An SDR (Attachment 1), electronic SDR (U/Groups/Everyone/SDR_Template.doc), or email version (Attachment 1a) is initiated at the time the discrepancy is observed, prior to the release of sample data. The individual (Initiator) identifying the discrepancy completes the header information indicating the client, analyses, samples affected and project related information. The type of deficiency and an explanation of the details surrounding the deficiency are recorded. The SDR is then transferred to the project manager (PM) for coordinating or approving of the action plan. The PM may need to contact the client to further develop the action plan or to obtain client approval for the action plan recommended by the laboratory. Documentation of this client contact and approval process is required either on the SDR or on an attachment to the SDR (e-mail response or letter). If the PM is not available, submit the SDR to the QA department for assistance in formulating an action plan. It is critical that sufficient time be given to the PM to determine the best course of action to meet the client's needs. The laboratory must not lose sight of the ultimate 'end use' of the client's data. The SDR is composed of six (6) sections which are described further below.

3.1 Initiator

The initiator documents the SDR with his or her name, date of the occurrence, pertinent client, sample, and data deliverable information. The initiator, PM or data management section manager will complete the contact information for forwarding effective documents.

3.2 Type of Sample Discrepancy

In this section, the initiator typically checks off or describes the type of sample discrepancy and lists specific concerns. The initiator signs/dates this section of the SDR in recognition that all the information is complete and accurate to the best of their knowledge. Upon completion of this section, the PM is then given the SDR.

3.3 PM Establish Action Plan

The PM, with assistance from any of the operating sections and or QA, will develop an action plan and indicate the steps for resolution of the discrepancy. The required personnel and specific actions to be taken are listed on the SDR. Data management personnel will route the SDR to the appropriate people indicated for action plan responsibilities. Upon completion of the requested task, each person will initial and date the actions taken and route the package to the next department for which action is required.

3.4 PM Final Approval

Once all actions are completed and before the analytical report is delivered to the client, the PM will review the SDR, assuring that all actions were completed. If all corrective actions are acceptable, the PM will sign the 'Final Approval' section. The SDR is scanned for inclusion in the client data report if PM indicates such routing. The electronic file is stored on the LAN (T:/RepGen/Sent/JobNumber.pdf or JobNumberMisc.pdf).
The original SDR is then routed to the QA department.

3.5 Receipt of Copies

Sample Log-in or Data management personnel distribute copies of the SDR to those people indicated by the PM. All actions taken are to be documented on the original SDR. This routing occurs through the SM and PM signature baskets located in the data management section.

3.6 Quality Assurance (QA)

All completed SDRs are routed to the QA department after scanning and placement in its respective Job folder. SDRs are periodically reviewed by QA personnel to help identify systematic or recurring problems. Once identified, goals are established with the objective of reducing or eliminating the problem. To accomplish this, action plans are developed by the QA personnel in cooperation with the laboratory staff. Implementation is scheduled and monitoring to determine if the action taken was effective in resolving the problem. This activity would be listed as a 'preventive action measure' or 'Quality System improvement item', which is summarized in the monthly QA Reports. Any SDR involving missed holding times (HTs) are, on a monthly basis, evaluated, and the information entered onto a missed HT tracking spreadsheet. This information is tabulated and summarized for inclusion in the monthly QA Reports. (U/Groups/Everyone/Holdtime.xls)

4.0 RESUBMITTED DATA REQUEST (RDRs)

RDRs are initiated for client requested review of data, requests for additional information or client complaints, which require a formal response (Attachment 2). The individual receiving the request completes the header information indicating the client samples affected and project related information. The type of deficiency and an explanation of the details are recorded. An action plan must be determined and clearly defined on the RDR. Depending on the nature of the problem, consultation with other sections such as project management, QA, data management, accounting, or operating sections may be needed to develop and approve an action plan. The RDR is composed of seven (7) sections, which are described further below.

An RDR may also take the form of an e-mail, (preferably the formatted electronic RDR - Attachment 2a) The request is typically initiated via e-mail by the client or data validator to the PM requesting a correction, additional information or clarification of data that was submitted. As with a paper RDR, an action plan must be determined and routed to appropriate personnel for completion. It is critical that the electronic request for data correction clearly outlines the actions required and taken by the laboratory just as if the RDR Form were used.

An RDR tracking number must be assigned to each RDR at the time that it is initiated. The RDR Tracking sheet is located in the All Public directory on the LAN. (U\Groups\Everyone\RDR_Tracking.xls) The initiator of the RDR assigns the next available tracking number to the RDR prior to routing it for completion. All completed RDR's are turned into the data management section leader, who on a monthly basis insures that the RDR Tracking table is complete, and that a completion is date entered on the spreadsheet. A check is also performed to ensure that a pdf file exists for the each RDR located in its associated job number folder on the LAN (T/Groups/RepGen/Sent/Job NumberREV_.pdf). The revision and number is appended to the job number.

4.1 Initiator

The initiator documents the RDR with his/her name, date of the occurrence, pertinent client, sample, and data deliverable information and assigns a tracking number to it. The initiator, PM or data management section manager will complete the contact information for forwarding the completed response.

4.2 Type of Data Deficiency

In this section, the initiator describes the type of data deficiency and lists specific concerns in the 'Explanation of Details' section. The initiator signs/dates this section of the RDR to indicate who initiated it and recognition that all the information is complete and accurate to the best of their knowledge.

4.3 Action Plan

This section documents the 'action plan' developed by the PM, reporting staff, section manager, or QA for the deficiency previously identified in detail. The necessary personnel and detailed actions to be taken are listed. Upon completion of the requested task, each person will initial and date this section, attach any corrected item, and route it to the next person listed on the action plan. Please note that if the corrected item is to replace a page from the original report, the page number it is replacing needs to be written on the bottom right hand corner of the page. If it is to be added as an additional page, the page it is to follow in the original report is added to the page with a letter designation starting with 'A', 'B', etc. for as many pages as is necessary.

4.3.1 Data Management

The RDR tracking number is used to gauge the progress and turnaround time of the designated action plan. This tracking list is maintained by the data management section, project management and QA and is available to all lab personnel on the laboratory's LAN. (U:/Groups/Everyone/RDR Tracking.xls) (Attachment 2b)
The data management section will assist in the routing of the RDR, which occurs through the Section Manager and PM signature baskets located in the data management section. They will also facilitate the submittal of the final product to the client and the documentation within LabNet how the data was submitted to the client in the form of Job Notes.

4.3.2 Project Manager (PM)

Once all actions are completed and before the report correction or other subsequent actions items are delivered to the client, the PM for the associated project will review the RDR, assuring that all actions were completed and then, if acceptable, will sign the 'Final Approval' section. The RDR and subsequent corrections are then scanned and stored electronically on the LAN (T:/RepGen/Sent/Job NumberREV_.pdf) with the identification of Job number followed by revision number.

4.3.3 Quality Assurance (QA)

Completed RDRs are routed to the QA department. RDRs are reviewed on a monthly basis. A summary and details of this review is included in the monthly QA report and is used to help resolve systematic or recurring problems. Quality goals can be established, action plans developed and implemented for the vital few recurring or systemic problems. This problem identification process and corrective action planning is identical to that outlined in section 3.6 for the SDRs.

5.0 CORRECTIVE ACTION REPORTS (CARS)

CARs are prepared for any quality related non-conformance to requirements other than sample specific client requirements, which should be addressed with an SDR. When CARs are initiated by the analyst or section manager, the form typically follows the example identified in Attachment 3. However, to expedite reporting, each laboratory section has specific formats to meet their needs and that contain the four basic reporting requirements.

CARs may be produced in a tabular or a custom format to deal with audit/assessment-identified non-conformance, or for other situations which identify more than a single non-conformance item. All corrective action reports will consist of four (4) basic elements. These are described further below.

5.1 Initiator

The initiator documents the CAR with his or her name, date of the occurrence, associated method or application and the client data that is directly affected by the non-conformance.

5.2 Description of the Non-conformance

The initiator details the type of non-conformance; lists specific concerns; and signs/dates this section of the CAR. This signature indicates that all the information is complete and accurate to the best of their knowledge. However, if the information is transmitted via e-mail, memo, or other format (i.e., tabular or audit report) indicating the initiator/date, then this information is sufficient and a signature is not required. The CAR may be routed for the development of an action plan to their immediate supervisor, when the situation is such that no clear guidance is listed in the associated method SOP.

5.3 Action Steps to Resolve the Non-Conformance

This section documents the "action plan" developed for the discrepancy or in the case of a request for response, such as an audit, this space may be blank and requested to be completed by an appropriate party. After resolution of the issue, the appropriate person will sign their response. However, if the information is transmitted via e-mail, memo, or other format (i.e., tabular or audit report) indicating the initiator/date, then this information is sufficient and a signature is not required.

5.4 Acknowledgment of Return-to-Control

In the case of an individual non-conformance, after all actions are complete, the analyst or supervisor will review the actions and document the return-to-control. If return-to-control has not been demonstrated, an SDR may be necessary to obtain further corrective action to meet specific project requirements. If the issue is a multiple non-conformance such as an audit report, the QA section or appropriate witness will assess the situation to assure that the corrective action has been effectively implemented.

6.0 PREVENTIVE ACTION

The quality assurance section uses various sources of information to determine preventive action measures. Proficiency Testing (PT) studies, CARs, SDRs, RDRs, internal and external audit reports, and other quality records are reviewed. Vital issues, suitable for preventive action recourse, can be determined by any laboratory staff member and submitted to the QA section.

The QA section summarizes vital issues in the monthly QA report. Potential corrective action steps are determined for the various vital issues and resources are directed to those issues which directly impact the quality of analytical data or laboratory services. The monthly quality assurance report is distributed and submitted to laboratory management for review and acknowledgment of corrective and preventive measures to be taken.

The monthly QA report is also an information vehicle used to document the effectiveness of corrective actions, status of tasks and new vital issues. This vehicle provides a continuous improvement loop to ensure that the application of actions and controls are effective. Also, it implicitly enacts a plan-do-check-act process loop with regard to preventive as well as corrective actions.

Since monthly QA reports, as well as the preventive information sources, are subsequently reviewed and summarized in the Quality Systems Management Review (UQA-002), the ultimate effectiveness of the preventive action process is again reviewed on a broader time scale.

7.0 ATTACHMENTS

Attachment 1: Example: Sample Discrepancy Report (SDR) Form
Attachment 1a: Example: Electronic (e-mail) SDR
Attachment 2: Example: Resubmitted Data Request (RDR) Form
Attachment 2a: Example: Electronic (e-mail) RDR
Attachment 2b: Example: RDR Tracking Sheet
Attachment 3: Example: Corrective Action Report (CAR) Form

Historical File:

Revision 00: 12/12/94
Revision 01: 04/10/96
Revision 02: 05/16/96
Revision 03: 02/24/98
Revision 04: 07/19/99
Revision 05: 08/07/00
Revision 06: 04/02/02
Revision 07: 09/25/03
Revision 08: 09/22/04

Reasons for Change; Revision 08:

- Annual Review - Update to clarify the use of LabNet Job Notes and the Sample Receipt Checklist for documenting sample discrepancies upon receipt of the samples at the laboratory.
- Clarification of the process used to evaluate and develop action plans for SDRs and RDRs that appear to be systematic or recurring errors.

U:\QC\SOP\QA\SOP-029.DOC

Attachment 1.

Example: Sample Discrepancy Report (SDR) Form

STL Chicago
Sample Discrepancy Report (SDR)

Lab Job #:

Client:	Analyses:
Contact:	
Project:	Matrix: Water Soil Other
Phone #:	Deliverable/Report Type: (circle)
	Level: 1 2 3 4 Type: MDL'U' RL'U' ND
FAX #:	Other

1.a. Type of Sample Discrepancy COC received: Yes No Quote from PM: Yes No

COC / Sample				LOG-IN		Client		Unit	
	ID Discrepancy		Rec'd past hold time		Log-in past hold time		Changed Analyses		Analyzed past hold time
	Date Discrepancy		Improper Preserv.		Log-in Error		Improper bottle type		Missing sample/extract
	Incomplete		Missing sample/extract				Label unreadable		Insufficient sample
	Unreadable		Container broken				Insufficient sample		
	Cooler temp.________C		- sample lost						
	Quote Discrepancy		- suspect contamination						
			Bubbles in VOA vials						
									EDD

1.b. Lab ID	(COC/Client ID)	Deficiency/Discrepancy

Initiator sign: Date:

2.a. PM Establish Action Plan:

	Cancel		Bottle/jar replaced		Change Test Code from________ to ________
	Add		Lid replaced		Change Due Date from________ to ________
	Place on hold		Analyze samples		Include in Case Narrative
	Log-in		Analyze Past Hold		Amend EDD
	Subcontract		Preserve then Analyze		

2.b.	Special Action:	Action Initiator		Action Completion	
Name:		Initial & Date:		Initial & Date:	

3. Receipt of Copies: (INITIAL AND DATE)

1. GC	4. WC
2. GC/MS	5. Digestions
3. Metals	6. Extractions
Distribution and Copy to QA:	

4. PM Final Approval of All Actions Taken:

______ Send copy to Client

Signature: Date:

5. QA For Quality Measurement Only:

Final Distribution - pdf to job file and send original to QA

STL CHICAGO

Sample Discrepancy Report (SDR)

Lab Job #

Client ______
Contact ______
Project ______
Phone ______
Fax ______

Analyses ______

Matrix ☐ Water ☐ Soil ☐ Other _____

Deliverable **Level** ☐ 1 ☐ **2** ☐ **3** ☐ **4** ☐ MDL'U' ☐ RL'U' ☐ ND ☐ Other

COC Received: ☐ Yes ☐ No   Quote from PM: ☐ Yes ☐ No

1A Type of Discrepancy

COC/Sample		*LOG-IN*	*Client*	*Unit*
☐ ID Discrepancy	☐ Rec'd past Hold Time	☐ Log-in past hold time	☐ Changed Analyses	☐ Analyzed past hold time
☐ Incomplete	☐ Improper Preservative	☐ Log-in error	☐ Improper Bottle Type	☐ Missing Sample/Extract
☐ Unreadable	☐ Missing Sample/Extract		☐ Label unreadable	☐ Insufficient Sample
☐ Cooler Temp. ______oC	☐ Container Broken		☐ Insufficient Sample	
☐ Quote Discrepancy	☐-Sample lost			
☐ Bubbles in VOA Vials	☐-Suspect Contamination			
☐ **Other** _____				☐ **EDD**

1B Lab ID   COC/Client ID   Description of Deficiency or Discrepancy

Initiator: Date:

2A PM Established Action Plan

☐ Cancel	☐ Bottle/jar replaced	☐ Change Test code from: _____ To: _____
☐ Add	☐ Lid replaced	☐ Change due date from: _____ To: _____
☐ Place on Hold	☐ Analyze past hold time	☐ Include in case narrative
☐ Log-in	☐ Preserve then analyze	☐ Amend EDD
☐ Subcontract	☐ Analyze	☐ **Other** _____

2B

Name	Special Actions	Initiator Initial	Initiator Date	Completion Initial	Completion Date
1	1				
2					
3					
4					
5					
6					
7					
8					
9					

3 Distribution

☐ GC	☐ Wet Chem
☐ GC/MS	☐ Digestions
☐ Metals	☐ Extractions
☐ Distribution to QA	☐ **Other** _____

4 Final Approval of All Actions

☐ Send Copy to Client
Notes:

PM Signature:
Date:

Attachment 1a.

Electronic (e-mail) Sample Discrepancy Report (SDR)

Sample Discrepancy Report (SDR)

Client:
Contact:
Project:
Job:
Date:

Deficiency/Discrepancy:

Action Plan:

-

Richard Wright
Project Manager
STL Chicago
2417 Bond Street
University Park, IL 60466
708-534-5200
708-534-5211 fax
rwright@stl-inc.com

Attachment 2.

Example: Resubmitted Data Request (RDR) Form

STL Chicago

Resubmitted Data Request (RDR)

Tracking No:

Date:	**Lab Lot #**	**Send Response to:**
Client:	**Analyses:**	Name:
Contact:	**Client ID#:**	Address:
Project:	**Date Needed:**	
	Deliverable/Report Type (circle)	Phone:
	Level: 1 2 3 4 Type: MDL'U' RL'U' ND	FAX:
	Other:	

1. Type of Data Deficiency: **2. Explanation of Details:**

_____ Missing Sample/Analysis
_____ Wrong Sample Identification
_____ Missing Pages
_____ Calibration in Question
_____ Results in Question
_____ Holdtime Violation
_____ Insufficient Data for Validation
_____ Explanation of Analysis
_____ EDD
_____ Other

Initiator Signature: ______________________ Date: __________

3. Establish an Action Plan: (PM, SM, RG, QA)		**4. Actions Completed:**	
Name:	Actions Required:	Initials:	Date:

6. Final Approval of All Actions Taken:

_________ Copy to Accounting for Invoice

PM Signature: ______________________ Date: __________

7. For Quality Improvement Measurement Only:

Attachment 2a.

Example:
Electronic (e-mail) Resubmitted Data Request (RDR) Format

Resubmitted Data Request (RDR)

Client:
Contact:
Project:
Job:
RDR #:
Date:

Analysis in Question:
Explain Problem:

Date CA Needed:

Action Plan:

- Include whether changes in results should be PDF'd, HC sent, EDD updated.

Richard Wright, Project Manager, STL Chicago, 2417 Bond Street, University Park, IL 60466
708-534-5200; 708-534-5211 fax; **rwright@stl-inc.com**

Attachment 2b.

Example: Resubmitted Data Request (RDR) Tracking Summary

STL Chicago

RDR Tracking Form-Active

Required Actions:	Check	Initials/Date	Additional Comments
Raw Data re-submittal Required			
Reprint Report			
Repint QC Report			
Revise Case Narrative			
Revise EDD			

RDR Tracking #	Date Initiated	Client	PM	Job Number	Unit of Error	Description of Error	Indicate (x) How Correction is to be Sent					Requested Due Date	Completion Date
							PDF	FAX	Hardcopy	EDD	Other		
1926													

Attachment 3.

Example: Corrective Action Report (CAR) Form

STL Chicago

Organics Corrective Action Report (CAR)

Test Code:____________________ Job #:____________________

Sample Matrix Resulted in:	Sample Prep. Information:	Analysis Information:
___ Florisil	___ Blown Hold Time	___ Initial Calibration
___ Acid	___ Smaller Sample Size	___ Retention Times Out
___ Mercury	___ Spiked Improperly	___ Cont. Calibration Out
___ Copper	___ Re-extraction Required	___ QC out of control
___ GPC	___ Other	___ Other (refer to Comments Section)
___ Dilution		
___ Other		

Comments:____________________

(Additional Comments on Back)

Action Required:____________________

Follow Up:____________________

Initiated By:____________________ Date:__________ Case Narrative Written By:____________________

Contributors:____________________ Date: __________

____________________ Date: __________

Approved:____________________ Date:____________________

CHI-22-17-010/C-1/99

Comments:

CHI-22-17-010/C-1/99

SEVERN TRENT STL

LABORATORY QUALITY MANUAL

STL Chicago
2417 Bond Street
University Park, Illinois 60466-3182
(708) 534-5200

Approved by (Signature / Date):

Michael J. Healy
Michael J. Healy
Laboratory Director

Terese A. Preston 6/4/04
Terese A. Preston
Quality Assurance Manager

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ISSUED TO :	

Full Signature Approvals Are Kept on File
with STL's QA Standard Practice Records

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SEVERN TRENT STL

Vision

STL will be the recognized industry leader for environmental analysis.

Mission

Through the innovation and dedication of our people, together with the quality of our systems, we will deliver levels of performance that delight our clients, retain the confidence of our stakeholders and enable the profitable growth of our business.

1.0 Introduction, Purpose, and Scope

1.1 STL Overview

STL Chicago (STL) is a part of Severn Trent Laboratories, a major group of U.S. based companies. The companies are owned by Severn Trent, plc, an international provider of water and wastewater services headquartered in Birmingham, UK.

STL is a full-service environmental laboratory that provides quality comprehensive and integrated professional analytical services effectively and efficiently. A broad range of environmental testing services are offered that span a variety of matrices including aqueous, saline, solid, tissue and drinking water.

Associated with this activity are services to assure client requirements are known, communicated and satisfactorily addressed, and a deliverables package presenting the analytical results. The laboratory provides expert personnel for supervision, technical consultation, and project review for effective planning and implementation of analytical assignments.

STL operates under the regulations and guidelines of the following federal programs:

- Air Force Center for Environmental Excellence (AFCEE)
- US Army Corp of Engineers, Hazardous, Toxic and Radioactive Waste (USACE HTRW)
- Clean Water Act (CWA)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Navy Facilities Engineering Service Center (NFESC)
- National Pollution, Discharge, and Elimination System (NPDES)
- Occupational Safety and Health Administration (OSHA)
- Resource Conservation and Recovery Act (RCRA)
- Safe Drinking Water Act (SDWA)
- Toxic Substances Control Act (TSCA)

STL also provides services under various state and local municipal guidelines. A current table of analytical services, list of certifications and general service listing is presented on the MySTL webpage or available from the laboratory. www.stl-inc.com

1.2 Quality Assurance Policy

It is STL's policy to:

- Provide high quality, consistent, and objective environmental testing services that meet all federal, state, and municipal regulatory requirements.
- Generate data that are scientifically sound, legally defensible, meet project objectives, and are appropriate for their intended use.
- Provide STL clients with the highest level of professionalism and the best service practices in the industry.
- Build continuous improvement mechanisms into all laboratory, administrative, and managerial activities.
- Maintain a working environment that fosters open communication with both clients and staff and ensures data integrity.

1.3 Management Commitment to Quality Assurance

STL management is committed to providing the highest quality data and the best service in the environmental testing industry. To ensure that the data produced and reported by STL meet the requirements of its clients and comply with the letter and spirit of municipal, state and federal regulations, STL maintains a quality system that is clear, effective, well communicated, and supported at all levels in the company.

Line organizations verify that specifications are achieved; QA organizations assist and provide oversight and verification of processes through planning, reviews, audits, and surveillances. The quality objectives are derived from this Laboratory Quality Manual (LQM), Standard Operating Procedures (SOPs) and Work Instructions.

1.4 Purpose

The purpose of the LQM is to describe STL's Quality System and to outline how that system enables all employees to meet the Quality Assurance (QA) policy. This LQM also describes specific QA activities and requirements and prescribes their frequencies. Roles and responsibilities of management and laboratory staff in support of the Quality System are also defined in this LQM.

1.5 Scope

This LQM is specific to STL Chicago's quality systems and laboratory operation's. All other STL locations have LQMs under the Corporate Quality Management Plan (QMP) or the Corporate QMP itself.

The laboratory is committed to ensuring that resources are available and deployed to meet client expectations. This includes gathering project information prior to sample receipt to ensure client expectations will be met with respect to:

- Sampling containers;
- Analytical methods employed;

- Accuracy and precision;
- Reporting limits;
- Personnel qualifications, training, and experience;
- Calibration and quality control measures employed;
- Regulatory requirements;
- Report contents;
- Supporting documentation, records and evidence; and
- Review of data

1.6 Servicing

Project Managers are the direct client contact and they ensure resources are available to meet project requirements. Although Project Managers do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure that available resources are sufficient to perform work for the client's project. Project Managers provide a link between the client and laboratory resources.

The laboratory has established procedures for performing and verifying that client servicing meets requirements. Typical services provided are:

- Sample Containers/Supplies – *Container Management: Process Operation* (UCM-001)
- Project QAP preparation – *Project Planning Process* (UPM-003)
- Regulatory advisory functions – *Project Planning Process* (UPM-003)
- Consulting -- *Project Planning Process* (UPM-003)

Regulatory and advisory functions are addressed under the same procedures used for project planning.

2.0 References

The following references were used in preparation of this document and as the basis of the STL Quality System:

EPA Guidance for Preparing Standard Operating Procedures (SOPs), EPA QA/G-6, US EPA, Office of Environmental Information, EPA/240/B-01/004, March 2001.

EPA Requirements for Quality Management Plans, EPA QA/R-2, US EPA, Office of Environmental Information, EPA/240,B-01/002 March 2001.

EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5, US EPA, Office of Environmental Information, EPA/240/B-01/003, March 2001.

EPA Quality Manual for Environmental Programs, 5360 A1, US EPA Office of Environmental Information – Quality Staff, May 2000.

General Requirements for the Competence of Testing and Calibration Laboratories, ISO/IEC 17025, December 1999.

Good Automated Laboratory Practices, Principles and Guidance to Regulations for Ensuring Data Integrity in Automated Laboratory Operations with Implementation Guidance, EPA 2185, US EPA Office of Information Resources Management, August 1995.

Air Force Center for Environmental Excellence (AFCEE) Quality Assurance Project Plan (QAPP), Version 3.1, August 2001.

National Environmental Laboratory Accreditation Conference, Constitution, Bylaws, and Standards, EPA 600/R-00/084, US EPA Office of Research and Development, June 2000.

Navy Installation Restoration Laboratory Quality Assurance Guide, Interim Guidance Document, Naval Facilities Engineering Service Center (NFESC), February 1996.

Navy Installation Restoration Chemical Data Quality Manual, Navy IR CDQM, Special Publication SP-2056-ENV, September 1999.

Department of Defense Quality Systems Manual for Environmental Laboratories, Version 1, October 2000.

Shell for Analytical Chemistry Requirements, US Army Corps of Engineers, EM 200-1-3, Appendix I, February 2001

This LQM was written to comply with the National Environmental Laboratory Accreditation Conference (NELAC) standards. Refer to Table 1 for a cross-section comparison of this LQM to the NELAC standards.

Table 1.

Correlation of QAPP Sections with NELAC 5.5.2 Quality Manual Requirements

NELAC Chapter 5.5.2 Quality Manual	Laboratory Quality Manual Section
a. Quality policy statement, including objectives and commitments	1.2 Quality Assurance Policy 4.2.1 Objectives of the Quality System
b. Organization and management structure	4.1 Organization and Management
c. Relationship between management, technical operations, support services and the quality systems	4.1.2 Roles and Requirements 4.2 Quality System
d. Records retention procedures; document control procedures	4.3 Document Control 4.12.2 Record Retention
e. Job descriptions of key staff and references to job descriptions of other staff	4.1.2 Roles and Requirements
f. Identification of laboratory approved signatories	4.1 Organization and Management
g. Procedures for achieving traceability of measurements	5.5 Measurement Traceability
h. List of all test methods under which the laboratory performs its accredited testing	5.3.1 Method Selection
i. Mechanisms for assuring the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work	4.4.2 Project-Specific Quality Planning

Table 1.

Correlation of QAPP Sections with NELAC 5.5.2 Quality Manual Requirements

NELAC Chapter 5.5.2 Quality Manual	Laboratory Quality Manual Section
j. Reference to the calibration and/or verification test procedures used	5.3.4 Method Verification 5.3.5 Method Validation & Verification Activities 5.3.6 Data Reduction & Review 5.4.3 Equipment Verification and Calibration
k. Procedures for handling submitted samples	4.7.1 Sample Acceptance Policy 5.7 Sample Handling, Transport and Storage
l. Reference to the major equipment and reference measurement standards used as well as the facilities and services used in conducting tests	1.6 Servicing 4.1.1 Laboratory Facilities 4.6 Purchasing Services & Supplies 5.2 Facilities 5.4.2 Equipment Maintenance 5.4.3 Equipment Verification and Calibration
m. Reference to procedures for calibration, verification and maintenance of equipment	5.4.2 Equipment Maintenance 5.4.3 Equipment Verification and Calibration
n. Reference to verification practices including inter-laboratory comparisons, proficiency testing programs, use of reference materials and internal QC schemes	5.8.1 Proficiency Testing 5.8.2 Control Samples
o. Procedures for feedback and corrective action whenever testing discrepancies are detected, or departures from documented procedures occur	4.8 Complaints 4.9 Control of Non-Conformances 4.10 Corrective Action 4.11 Preventive Action 5.8.6 Permitting Departures from Documented Procedures
p. Laboratory management arrangements for exceptionally permitting departures from documented policies and procedures	4.4.1 Contract Review 4.4.2 Project-Specific Quality Planning 5.8.6 Permitting Departures from Documented Procedures
q. Procedures for dealing with complaints	4.8 Complaints
r. Procedures for protecting confidentiality and proprietary rights	4.7.2 Client Confidentiality and Proprietary Rights
s. Procedures for audits and data review	4.13 Internal Audits 4.14 External Audits 5.3.6 Data Reduction and Review
t. Process/procedures for establishing that personnel are adequately experienced in duties they are expected to carry out and are receiving any needed training	5.1.2 Training
u. Ethics policy statement developed by the laboratory and training personnel in their ethical & legal responsibilities	5.1.3 Ethics Policy
v. Reference to procedures for reporting analytical results	5.3 Test Methods 5.3.6 Data Reduction and Review 5.9 Project Reports
w. Table of contents, listing reference, glossaries and appendices	TOC Table of Contents Appendix List of Cited SOPs and Work Instructions

3.0 Terms and Definitions

Accuracy: The degree of agreement between a measurement and true or expected value, or between the average of a number of measurements and the true or expected value.

Audit: A systematic evaluation to determine the conformance to specifications of an operational function or activity.

Batch: Environmental samples, which are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation batch is composed of 1 to 20 environmental samples of a similar matrix, meeting the above mentioned criteria. Where no preparation method exists (e.g., volatile organics, water), the batch is defined as environmental samples that are analyzed together with the same process and personnel, using the same lots of reagents, not to exceed 20 environmental samples. An analytical batch is composed of prepared environmental samples, extracts, digestates or concentrates that are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Chain of Custody (COC): A system of documentation demonstrating the physical possession and traceability of samples.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund): Legislation (42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and reauthorization Act of 1986 (SARA), 42 U.S.C. 9601et seq.

Compromised Sample: A sample received in a condition that jeopardizes the integrity of the results. See Section 4.7.1 for a description of these conditions.

Confidential Business Information (CBI): Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products.

Confirmation: Verification of the presence of a component using an additional analytical technique. These may include second column confirmation, alternate wavelength, derivatization, mass spectral interpretation, alternative detectors, or additional cleanup procedures.

Corrective Action: Action taken to eliminate the causes of an existing non-conformance, defect or other undesirable situation in order to prevent recurrence.

Data Audit: A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Demonstration of Capability (DOC): Procedure to establish the ability to generate acceptable accuracy and precision.

Detection Limit Check Standard (DLCK): A non-processed standard spiked at approximately ½ the method reporting limit. Used in conjunction with the MRL Check standard in LGC analysis.

Equipment Blank (EB): A portion of the final rinse water used after decontamination of field equipment; also referred to as Rinsate Blank and Equipment Rinsate.

Extraction Blank (EB1, EB2, EB3): A blank that has been taken through the extraction procedure such as TCLP/SPLP; 5035, AVS/SEM.

Document Control: The act of ensuring that documents (electronic or hardcopy and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA): Legislation under 7 U.S.C. 135 et seq., as amended.

Federal Water Pollution Control Act (Clean Water Act, CWA): Legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat. 816.

Field Blank (FB): A blank matrix brought to the field and exposed to field environmental conditions.

Field Duplicate (FD): Duplicate field-collected sample.

Field of Testing (FOT): A field of testing is based on NELAC's categorization of accreditation based on program, matrix and analyte.

Good Laboratory Practices (GLP): Formal regulations for performing basic laboratory operations outlined in 40 CFR Part 160 and 40 CFR Part 729 and required for activities performed under FIFRA and TSCA.

Holding Time: The maximum time that a sample may be held before preparation and/or analysis as promulgated by regulation or as specified in a test method.

Instrument Blank: A blank matrix that is the same as the processed sample matrix (e.g. extract, digestate, condensate) and introduced onto the instrument for analysis.

Internal Chain of Custody (COC): An unbroken trail of accountability that ensures the physical security of samples, data and records. Internal COC refers to additional documentation procedures implemented within the laboratory that includes special sample storage requirements, and documentation of all signatures and/or initials, dates, and times of personnel handling specific samples or sample aliquots.

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is $\pm$100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Laboratory Control Sample (LCS): A blank matrix spiked with a known amount of analyte(s), processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

Laboratory Quality Manual (LQM): A document stating the quality policy, quality system and quality practices of the laboratory. The LQM may include by reference other documentation relating to the laboratory's quality system.

Limit of Detection (LOD): The minimum amount of a substance that an analytical process can reliably detect.

Matrix: The substrate of a test sample. Common matrix descriptions are defined in Table 2.

Table 2. Matrix Descriptions

Matrix	Description
Aqueous	Aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine source. Includes surface water, groundwater, effluents, leachates and wastewaters.
Drinking Water	Aqueous sample that has been designated a potable water source.
Saline	Aqueous sample from an ocean or estuary, or other salt-water source such as the Great Salt Lake.
Liquid	Liquid with <15% settleable solids.
Solid	Soil, sediment, sludge, ash, paint chips, filters, wipes or other matrices with ≥15% settleable solids.
Waste	A product or by-product of an industrial process that results in a matrix not previously defined (i.e., drum liquid or oils).
Tissue	Sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Matrix Duplicate (MD): Duplicate aliquot of a sample processed and analyzed independently; under the same laboratory conditions; also referred to as Sample Duplicate; Laboratory Duplicate.

Matrix Spike (MS): Field sample to which a known amount of target analyte(s) is added.

Matrix Spike Duplicate (MSD): A replicate matrix spike.

Method Blank (MB): A blank matrix processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

Method Detection Limit (MDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ±100%. The MDL represents a range where qualitative detection occurs using a specific method. Quantitative results are not produced in this range.

Method Detection Limit Check (MDLCK): A standard that is processed with the MDL Study that is spiked at approximately ½ the low standard or reporting limit in the method.

Method Reporting Limit Check (MRL): A standard that is not processed, is spiked at approximately 2x the low standard or reporting limit. This standard check is used in conjunction with the LCG analysis.

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Precision: An estimate of variability. It is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions.

Preservation: Refrigeration and/or reagents added at the time of sample collection to maintain the chemical, physical and/or biological integrity of the sample.

Proficiency Testing: Determination of the laboratory calibration or testing performance by means of inter-laboratory comparisons.

Proficiency Test (PT) Sample: A sample, the composition of which is unknown to the analyst, that is provided to test whether the analyst/laboratory can produce analytical results within specified performance limits. Also referred to as Performance Evaluation (PE) Sample.

Proprietary: Belonging to a private person or company.

Quality Assurance (QA): An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance (Project) Plan (QAPP): A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

Quality Control (QC): The overall system of technical activities, the purpose of which is to measure and control the quality of a product or service.

Quality Control (QC) Sample: A control sample, generated at the laboratory or in the field, or obtained from an independent source, used to monitor a specific element in the sampling and/or testing process.

Quality Management Plan (QMP): A formal document describing the management policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an agency, organization or laboratory to ensure the quality of its product and the utility of the product to its users.

Quality System: A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA/QC.

Quantitation Limit (QL): The minimum amount of a substance that can be quantitatively measured with a specified degree of confidence and within the accuracy and precision guidelines of a specific measurement system. The QL can be based on the MDL, and is generally calculated as 3-5 times the MDL, however, there are analytical techniques and methods where this relationship is not applicable. Also referred to as Practical Quantitation Level (PQL), Estimated Quantitation Level (EQL), Limit of Quantitation (LOQ).

Raw Data: Any original information from a measurement activity or study recorded in laboratory notebooks, worksheets, records, memoranda, notes, or exact copies thereof and that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic/optical media, including dictated observations, and recorded data from automated instruments. Reports specifying inclusion of "raw data" do not need all of the above included, but sufficient information to create the reported data.

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Standard: A standard, generally of the highest metrological quality, available at a given location from which measurements made at that location are derived.

Reporting Limit (RL): The level to which data is reported for a specific test method and/or sample. The RL is generally related to the QL. The RL must be minimally at or above the MDL.

Resource Conservation and Recovery Act (RCRA): Legislation under 42 U.S.C. 321 et seq. (1976).

Safe Drinking Water Act (SDWA): Legislation under 42 U.S.C. 300f et seq. (1974), Public Law 93-523.

Sampling and Analysis Plan (SAP): A formal document describing the detailed sampling and analysis procedures for a specific project.

Selectivity: The capability of a measurement system to respond to a target substance or constituent.

Sensitivity: The difference in the amount or concentration of a substance that corresponds to the smallest difference in a response in a measurement system using a certain probability level.

Spike: A known amount of an analyte added to a blank, sample or sub-sample.

Standard Operating Procedure (SOP): A written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Storage Blank: A blank matrix stored (2-weeks) with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination. OR A blank matrix stored with field samples of a similar matrix.

Systems Audit: A thorough, systematic, on-site, qualitative review of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system.

Test Method: Defined technical procedure for performing a test.

Toxic Substances Control Act (TSCA): Legislation under 15 U.S.C. 2601 et seq., (1976).

Traceability: The property of a result of a measurement that can be related to appropriate international or national standards through an unbroken chain of comparisons.

Trip Blank (TB): A blank matrix placed in a sealed container at the laboratory that is shipped, held unopened in the field, and returned to the laboratory in the shipping container with the field samples.

Verification: Confirmation by examination and provision of evidence against specified requirements.

4.0 Management Requirements

The organizational chart of STL is presented in Figure 1. Corporate employees are located at various STL facilities as outlined in the organizational structure. The organizational chart of STL Chicago is presented in Figure 2.

4.1 Organization and Management

The Laboratory Director and Quality Assurance Manager are responsible and have the signature authority for approving and implementing this plan. Additional signatory authorities for the approval of work and release of reports are defined in the *Signature Authority* SOP (UQA-030).

SEVERN TRENT STL

Severn Trent Laboratories, Inc.
Management Structure
January 1, 2004

President / CEO
Rachel Brydon Jannetta

Sr. VP / COO
Dr. Keith Wheatstone

Sr. VP / CFO
Heather Collins Villemaire

VP Bus. Development
Jim Miller

HR Director
Nancy Ploof

VP Client & Operations Services
Dr. Charles Carter

General Managers

Corporate Controller
Leslie Bowers

HR Managers

Chief Information Officer
Dan Santaniello

Laboratory Directors

Financial Accounting

Corporate QA Director
Ray Frederici

Business Development Directors

Lead Business Controller
Lisa Long

Account Executives

Business Controllers

Environmental H&S Director
Nathan Nunn

Legal & Contracts Director
Sharon Gordon

Director of Technical Services
Richard Burrows

Corporate Client Services Director
Bosco Ramirez

Figure 1. STL Organization Chart

STL Chicago Operations

- **Laboratory Director** Mike Healy
  - **Receptionist/AR** S. Scott
  - **QA Manager** T. Preston; M. Krueding
  - **Decatur Service Center** Customer Service Manager D. Ingersoll; J.Andrews
  - **MIS** T. Wilson
  - **Sample Control/ Field Services/Waste** J. James
    - **Field Services/Waste**: D. Kaczka, J. Kaczka, E. Schmude
    - **Sample Log-In**: S. Kelsey, J. Lunt
    - **Bottle Prep**: E. Lesiak, D. Jones, PT
  - **Customer Service Manager** E. Lang
    - **Project Managers**: L. Mackley, R. Mannz, N. McDonald, B. Stadelmann, R. Wright
    - **Proposal Coordinator**: C. Pritchard
  - **Facilities/H&S** D. Mazur
    - **Maintenance**: A. Tobeck
  - **Report Production/ HR/Purchasing** K. LeClair
    - **Report Production**: P. Buckley, J. Healy, PT
    - **EDDs**: J. Bracken, D. Dillard, K. Nelson
    - **Records Management**: S. Kargas
  - **GC/MS** G. Rynkar
    - **VOA**: J. Petruszak, Supervisor, E. Alikpala, D. Drabek, C. Duran, L. Manzano, J. Nagel, G. Swaney, J. O'Gorman, PT
    - **Semi-VOA**: D.Akcakal, J. Bergen, D. Kozubal, G. Orf
    - GC VOA: W. Estes
    - **Technical Manager**: M.. Kobus
  - **Organic Prep/ Chromatography** P. Gibson
    - **Organic Prep.**: D. Knieriemen, Supervisor, E. Carbajal, L. Hart, M. Kras, E. Lutin, PT, L. Martinez, PT, L. Matthies, B. Thompson
    - **Chromatography**: K. Lesiak, S. Newkirk, J. Price, B. Werner
    - **Glassware**: D. Rutnicki
  - **Metals** J. Wojcik
    - D. Johnson, G. Klee, P. Kolarczyk, L. Roots, T. Smith
    - **Metals Prep**: R. Cann, C. Bonner
  - **Wet Chemistry** D. Harperr
    - M. Brogan, K. Deb, PT, P. Ficarello, J. Kitchens, R. Muno, N. Pierce, C. Sullivan, PT
    - **Glassware**: S. Oliver

May 27, 2004

Figure 2. STL Chicago Organizational Chart

4.1.1 Laboratory Facilities

The laboratory is located in University Park, IL, which is approximately 30 miles south of Chicago, and is staffed by 84 professionals. The laboratory is comprised of 51,000 square feet of state-of-the-art commercial laboratory and office space and houses both inorganic and organic operations. The facility is divided into separate work areas to facilitate sample throughput. These areas include the following:

- Sample receipt and refrigerated storage
- Organic sample preparation
- Glassware preparation
- Metals digestion
- Wet chemistry laboratory
- Instrumentation laboratories

The main instrumentation laboratory is equipped with state-of-the-art instrumentation and sufficient duplicate equipment to provide back-up service for most major systems. A listing of laboratory equipment and instrumentation is referenced as Work Instruction No. CHI-22-09-103. Table 3 is a summary of the major laboratory instruments.

Table 3. Major Equipment List

GC	GC/MS	AA	ICP	CVAA	HPLC	AutoAnalyzer	IC	TOC	TOX
15	14	3	3	2	6	2	2	2	2

Each of these areas has separate heating, ventilation, and air conditioning systems. Non-destructive gas chromatographic detectors and GC/MS rotary pumps are vented out of the instrumentation through charcoal filters.

4.1.2 Roles and Responsibilities

The specific duties and responsibilities of the Laboratory Director, Quality Assurance Manager, Project Managers, Technical Managers, Sample Management Coordination, Data Management Section Manager, Quality Assurance Specialist, Health and Safety Coordinator/Waste Management, Information Technology Manager, and Chemists/Technicians are as follows.

In the absence of any one individual, the staff or assistant within each department is professionally skilled in the ability to administer the function of the administrator or support personnel. This will allow for the continuance of the day-to-day operations of the laboratory.

4.1.2.1 Laboratory Director

The ultimate responsibility for the generation of reliable laboratory data rests with the Laboratory Director, who is accountable to his General Manager and oversees the daily operations of the laboratory. The Laboratory Director's responsibilities include allocation of personnel and resources, setting goals and objectives for both the business and employees, achieving the financial, business and quality objectives of STL. Furthermore, to see that all tasks performed in the laboratory are conducted according to the requirements of this LQM, the Project Technical Profile and/or the appropriate QAPP; and to assure that the quality of service provided complies with the project's requirements.

The Laboratory Director has the authority to affect those policies and procedures to ensure that only data of the highest level of excellence are produced. As such, the Laboratory Director supports a QA Section which has responsibilities independent from sampling and analysis.

The Laboratory Director, with the assistance of the Quality Assurance Manager, has the overall responsibility for establishing policies that ensure the quality of analytical services meet our clients expectations. These policies are defined in this LQM.

4.1.2.2 Quality Assurance Manager

The Quality Assurance (QA) Manager has the full-time responsibility to evaluate the adherence to policies and to assure that systems are in place to produce the level of quality defined in this LQM. The QA Manager is responsible for the approval of IDL/MDL studies, method validation studies, IDOC and CDOC evaluations, the annual review of statistical control limits, data package inspections, and LIMS system method development, validation and maintenance. In addition, the QA Manager assists in the preparation, compilation, and submittal of quality assurance plans; reviews program plans for consistency with organizational and contractual requirements and advises appropriate personnel of deficiencies. The QA Manager is assisted by the QA Specialist in the maintenance of QA records, certifications, accreditations, internal and external audits, corrective action procedures, management of the laboratory's PT Program, and maintenance of training documentation.

The QA Manager shall have the final authority to accept or reject data, and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data. The QA Manager is available to any employee at the facility to resolve data quality or ethical issues. The QA Manager must address any data integrity issue identified internally or externally, establish a corrective action plan and resolve the issue to the client's satisfaction. Issues that involve data recall must be discussed with the Corporate Quality Director Ray Frederici. The QA Manager shall be independent of laboratory operations and has an indirect reporting relationship to the QA Director.

4.1.2.3 Project Managers

The laboratory recognizes the importance of efficient project management. The laboratory Project Managers (PM) are responsible for preparing the Project Technical Profile which summarizes QA/QC requirements for the project, maintaining the laboratory schedule, ensuring that technical requirements are understood by the laboratory, and advising the Laboratory, QA and Technical Managers of all variances. The laboratory Project Manager will provide technical guidance and the necessary laboratory-related information to the preparer of project-specific QAPPs and provide peer review of the final document to ensure accuracy of the laboratory information.

4.1.2.4 Technical Managers

The Technical Managers are the Laboratory Director, laboratory Section Managers and the QA Manager. They are as follows:

- Michael J. Healy, Laboratory Director, BS Environmental Biology,
- 22 years laboratory experience.
- Terese A. Preston, Quality Assurance Manager, BA Biology,
- 20 years laboratory experience.
- Diane L. Harper, Inorganics Section Manager, MA Biology,
- 24 years laboratory experience.
- Jodi L. Wojcik, Metals Section Manager, BS Biology,
- 18 years laboratory experience.
- Patti J. Gibson, Chromatography/Organic Extractions Section Manager, BS Biology,
- 15 years laboratory experience.
- Gary L. Rynkar, GC/MS Section Manager, BS Environmental Biology,
- 16 years laboratory experience.

All of these managers report to the Laboratory Director and serve as the technical experts on assigned projects, provide technical liaison, assist in resolving any technical issues within the area of their expertise; and implement established policies and procedures to assist the Laboratory Director in achieving section goals. The Technical Managers are responsible for ensuring that their personnel are adequately trained to perform analyses; that equipment and instrumentation under their control is calibrated and functioning properly; that system and performance audits are performed on an as-needed basis; provide input and review in the development and implementation of project-specific QA/QC requirements; and for providing the critical review of proposal and project work for programs as directed by the Laboratory Director. The Technical Managers coordinate these activities with the project management and quality assurance sections.

4.1.2.5 Sample Management Coordination

The Project Manager is designated as the Sample Management Coordination for any work subcontracted under their management. The Project Manager verifies each subcontracting request to ensure that special client restrictions are not jeopardized (e.g., samples must be analyzed by the receiving affiliated or network laboratory and must maintain specific certification(s)). The Project Manager is also responsible for verifying the credentials; establishing the service agreement; ensuring data review; and invoicing of all laboratory subcontractors. The Project Manager discusses any deficiencies or anomalies with the subcontractor prior to reporting any data to the client.

4.1.2.6 Data Management Section Manager

The Data Management Section Manager is responsible for coordinating receipt of all data from the various service groups within the laboratory, reviewing data for compliance to laboratory QC criteria and/or criteria in the Project Technical Profile, and ensuring that data are reported in a timely manner and in the proper format.

4.1.2.7 Quality Assurance Specialist

The QA Specialist is responsible for QA documentation and involvement in the following activities:

- Assist the QA Manager in performing the annual internal laboratory audits, compiling the evaluation, and coordinating the development of an action plan to address any deficiency identified.
- Facilitate external audits, coordinating with the QA Manager and Laboratory Staff to address any deficiencies noted at the time of the audit and subsequently presented in the final audit report.
- Assist the QA Manager in the preparation of new SOP's and in the maintenance of existing SOPs, coordinating annual reviews and updates.
- Manages the performance testing (PT) studies, coordinates follow up studies for failed analytes and works with QA Manager and Laboratory Staff to complete needed corrective action reports.
- Personnel training records review and maintenance.
- Document control maintenance.
- Assists the Quality Manager and Project Management Group in the review of program plans for consistency with organizational and contractual requirements. Summarize and convey to appropriate personnel anomalies or inconsistencies observed in the review process.
- Manages certifications and accreditations.
- Monitors for compliance the following QA Metrics: Temperature Monitoring of refrigeration units and incubators; thermometer calibrations; balance calibrations; eppendorf/pipette calibrations; and proper standard/reagent storage.
- Periodic checks on the proper use and review of instrument logs.
- Initiate the Mint-miner data file review process for organic instrumentation. Maintain tracking sheet of activity.
- Initiate the annual Instrument review.
- Assist in the technical review of data packages which require QA review.

4.1.2.8 Health and Safety Coordinator / Waste Management

The Health and Safety Coordinator is responsible for the safety and well-being of all employees while at the laboratory. This includes, but is not limited to, administering the Corporate Safety Manual that complies with federal regulations, MSDS training and review, conducting laboratory safety orientation and tours for all new employees, providing instructions on safety equipment, cleaning up laboratory spills, and instructing personnel of laboratory procedures for emergency situations. The Health and Safety Coordinator is on-call 24-hours a day, 7-days a week for all laboratory situations.

The Health and Safety Coordinator responsibilities additionally include waste management of laboratory generated hazardous waste in accordance with appropriate regulations. This includes maintenance of required documentation, such as waste manifests, segregation of waste in accordance with requirements, and training of personnel in proper segregation of waste.

4.1.2.9 Information Technology Manager

The overall role of the Information Technology (IT) Manager is to enhance laboratory productivity through improved information access, flow, and security. For information to be of greatest value, it must be readily accessible and reliable. It is the responsibility of the IT Manager to provide software tools that allow quick and user friendly access to that information, while at the same time controlling access to that information to those that have the need and proper authority.

Information flow can be enhanced through automation. Automation is the minimization of human intervention in a process. Reduction in human intervention can result in significant error reductions and time savings. The IT Manager assists the laboratory in automation by providing hardware and software solutions to help minimize human intervention in data collection, processing, and storage.

The IT Manager is responsible for providing data security by controlling access, as mentioned above, and for providing for disaster recovery. Data stored on the central Laboratory Information Management System (LIMS, a.k.a., LabNet) is the direct responsibility of the IT Manager. No fewer than two copies of all data should exist at any time so that lost or destroyed data can always be retrieved from an alternate source. These copies may consist of data within the system and on magnetic tape in the case of live data, or two copies on magnetic tape for archived data. Data stored electronically in other departments is the direct responsibility of those departments. However, the IT Manager is responsible for providing procedures and training to all laboratory operations, as appropriate, to assist in making backup copies of local data within the respective operating unit.

STL has established procedures for IT management:

- *Internet Use Policy* – P-I-001
- *Electronic Mail Use* – P-I-002
- *Computer Systems Account and Naming Policy* – P-I-003
- *Computer Systems Password Policy* – P-I-004
- *Software Licensing Policy* – P-I-005
- *Virus Protection Policy* – P-I-006

4.1.2.10 Chemists / Technicians

Any effective laboratory quality assurance/quality control program depends on the entire organization, including management and every individual on the laboratory staff. The initial review for acceptability of analytical results rests with the analysts conducting the various tests. Observations made during the performance of an analytical method may indicate that the analytical system is not in control. Analysts must use quality control indicators to assure that the method is in-control before reporting results.

4.2 Quality System

Organizational support for implementing the quality system and achieving the quality objectives is derived from this LQM, SOPs and Work Instructions. Within these documents, management with executive responsibilities ensures that the quality policy is understood, implemented, and maintained at all levels of the organization. The development and implementation of appropriate accountabilities, duties, and authority by organizational positions are clearly delineated. Line organizations achieve and verify that specifications are achieved; QA organizations assist and provide oversight and verification of processes through planning, reviews, audits, and surveillances. Top management leadership, support and direction ensures that the policies and procedures are appropriately implemented.

4.2.1 Objectives of the Quality System

The goal of the quality system is to ensure that business operations are conducted with the highest standards of professionalism in the industry.

To achieve this goal, it is necessary to provide our clients with not only scientifically sound, well documented, and regulatory compliant data, but also to ensure that we provide the highest quality service available in the industry with uncompromising data integrity. A well-structured and well-communicated quality system is essential in meeting this goal. The laboratory's quality system is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

As stated in Section 1.3, this LQM, Work Instructions and the SOPs themselves are the basis and outline for our quality and data integrity system and contains requirements and general guidelines under which the laboratory conducts our operations. In addition, other documents may be used by the laboratory to clarify compliance with quality system or other client requirements. As you read this LQM, you will note SOP or Work Instruction numbers in parenthetic text. These numbers refer to the laboratory procedure(s) associated with the subject item. A table listing these quality system policies and procedures is appended to this document.

The QA Manager and QA Specialist are responsible for implementing and monitoring the Quality System. The QA Manager reports to the Laboratory Director on the performance of the quality system for review and continuous improvement. The QA Manager has sufficient authority, access to work areas, and organizational freedom (including sufficient independence from cost and schedule considerations) to:

- Initiate action to prevent the occurrence of any nonconformities related to product, process and quality system,
- Identify and record any problems affecting the product, process and quality system,
- Initiate, recommend, or provide solutions to problems through designated channels,
- Verify implementation of solutions, and
- Assure that further work is stopped or controlled until proper resolution of a non-conformance, deficiency, or unsatisfactory condition has occurred and the deficiency or unsatisfactory condition has been corrected.

The QA Manager reports where appropriate action can be affected. However, should a situation arise where acceptable resolution of identified problems cannot be agreed upon at the laboratory level, direct access to STL's Corporate Quality Director is available. This provides laboratory QA personnel non-laboratory management support, if needed, to ensure that QA policies and procedures are enforced.

The QA Manager or QA Specialist conducts annual LQM training for all laboratory and administrative personnel to ensure their familiarity with the quality documentation and the implementation of the policies and procedures in their work.

4.3 Document Control

The laboratory maintains procedures to control documents and analytical data. Since intensive data is generated and this is our primary product, document control is inherently segregated from data control, as described further in Sections 4.3.1 and 4.3.2.

4.3.1 Document Control Procedure

Security and control of documents are necessary to ensure that confidential information is not distributed and that all current copies of a given document are from the latest applicable revision (*Document Control*; UQA-006). Unambiguous identification of a controlled document is maintained by identification of the following items in the document header: Document Number, Revision Number, Effective Date, and Number of Pages. Document control may be achieved by either electronic or hardcopy distribution.

Controlled documents are authorized by the QA Department and are marked as either "Controlled' or "Uncontrolled" and records of their distribution are kept by the QA Department. Controlled status is defined as the continuous distribution of document updates. Uncontrolled status is defined as the single distribution of the current SOP. Document updates are not distributed to uncontrolled status holders. For tracking purposes, a control copy number is assigned to documents distributed with a controlled status. All copy numbers are written or typed in red to easily identify the SOP as a controlled copy.

4.3.1.1 Document Revision

Changes to documents occur when a procedural change warrants a revision of the document. When an approved revision of a controlled document is ready for distribution, obsolete copies of the document are replaced with the current version of the document. The previous revision of the controlled document is stamped "ARCHIVED COPY" and is filed by the QA Specialist in the QA library. Only the most current revision is maintained electronically.

SOPs are updated on a 12-18 month basis, which is tracked by an established review schedule (*Approved SOP Listing*; CHI-22-09-SOP List). These reviews are conducted by the creator of the SOP and/or Department Manager, QA Specialist and/or QA Manager, and the Health and Safety Coordinator, all of whom provide the approval signature for each SOP.

4.3.2 Data Control

All raw data, such as bound logbooks, instrument printouts, magnetic tapes, electronic data, as well as final reports, are retained for a minimum period of 5 years. Such data may be maintained longer, as defined by client and project requirements. The procedure for archiving records and client or project specific requirements is contained in the *Record Retention and Purging* SOP (UDM-002).

Raw data and reports are documented and stored in a manner in which they are easily retrievable. The procedure for maintaining raw data records is briefly described below:

- Instrument print-outs for conventional inorganic parameters are filed by LabNet Batch Number. Inorganic Metals are filed by Instrument and Filename. Generally, current year and previous year documents are kept on file in the laboratory sections.
- All raw data, for example, instrument print-outs and logbooks, are maintained in an on-site and secured storage area.
- The computer information is backed up on tape daily, and stored in a secured and temperature/humidity controlled environment to maintain the integrity of the electronic information in the event of system failure. Copies of all back-up tapes are maintained in secured off-site locations.
- All copies of client final reports are maintained electronically (e.g., Adobe Acrobat).

4.4 Request, Tender, and Contract Review

4.4.1 Contract Review

For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is STL's intent to provide both standard and customized environmental laboratory services to our clients. To ensure project success, technical staff performs a thorough review of technical and QC requirements contained in contracts. Contracts are reviewed for adequately defined requirements and STL's capability to meet those requirements.

All contracts entered into by the laboratory are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity, accuracy, and precision requirements. The reviewer ensures that the laboratory's test methods are suitable to achieve these requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The review also includes the laboratory's capabilities in terms of turnaround time, capacity, and resources to provide the services requested, as well as the ability to provide the documentation, whether hardcopy or electronic. If the laboratory cannot provide all services but intends to subcontract such services, whether to another STL facility or to an outside firm, this will be documented and discussed with the client prior to contract approval.

Any contract requirement or amendment to a contract communicated to STL verbally is documented and confirmed with the client in writing. Any discrepancy between the client's requirements and STL's capability to meet those requirements is resolved in writing before acceptance of the contract. Contract amendments, initiated by the client and/or STL, are documented in writing for the benefit of both the client and STL.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the permanent project record as defined in Section 4.12.1.

4.4.2 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, STL assigns a Project Manager (PM) to each client. The PM is the first point of contact for the client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project (*Project Planning Process*; UPM-003). QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the direct client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure that the available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project Technical Profile (e.g., LabNet Project Notes) turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through *Project Kick-Off Meetings (UPM-002)* or to the supervisory staff during *Production Meetings (UPM-004)*. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, the LabNet Project Notes are associated with each sample batch (e.g., Job) as a reminder upon sample receipt and analytical processing.

Any changes that may occur within an active project is agreed upon between the client/regulatory agency and the Project Manager/laboratory. These changes (e.g., use of a non-standard method or modification of a method) must be documented prior to implementation. Documentation pertains to any document, e.g., letter, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory through the management Production Meetings which are conducted three times per week (T,W,Th). Such changes are updated to the LabNet Project Notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the Project Manager or the individual laboratory section manager. After the modification is implemented into the laboratory procedure, documentation of the modification is made in the case narrative of the data report(s).

STL strongly encourages our clients to visit the laboratory and hold formal or informal sessions with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

4.4.3 Data Quality Objectives

Data quality objectives (DQO) are qualitative and quantitative statements used to ensure the generation of the type, quantity, and quality of environmental data that will be appropriate for the intended application. Typically, DQOs are identified before project initiation and during the development of a QAPPs and SAPs. The analytical DQOs addressed in this section are precision, accuracy, representativeness, completeness, and comparability.

The components of analytical variability (uncertainty) can be estimated when QC samples of the right types and at the appropriate frequency are incorporated into the measurement process of the laboratory. STL incorporates numerous QC samples to obtain data for comparison with the analytical DQOs and to ensure that the measurement system is functioning properly. The control samples and their applications, described in Section 5.8.2, are selected based on regulatory, method- or client-specific requirements. Analytical QC samples for inorganic and organic analyses may include calibration blanks, instrument blanks, method blanks, LCS, calibration standards, MS, MSD, MD, surrogate spikes, and yield monitors.

The DQOs discussed below ensure that data are gathered and presented in accordance with procedures appropriate for its intended use, that the data is of known and documented quality, and are able to withstand scientific and legal scrutiny.

4.4.3.1 Precision

Precision is an estimate of variability. It is an estimate of agreement among individual measurements of the same physical or chemical property, under prescribed similar conditions. Precision is expressed either as Relative Standard Deviation (RSD) for greater than two measurements or as Relative Percent Difference (RPD) for two measurements. Precision is determined, in part, by analyzing data from LCSs, MS, MSD, and MD. A description of these control samples is provided in Section 5.8.2.

Precision also refers to the measurement of the variability associated with the entire process, from sampling to analysis. Total precision of the process can be determined by analysis of duplicate or replicate field samples and measures variability introduced by both the laboratory and field operations.

4.4.3.2 Accuracy

Accuracy is the degree of agreement between a measurement and the true or expected value, or between the average of a number of measurements and the true or expected value. It reflects the total error associated with a measurement.

Both random and systematic errors can affect accuracy. For chemical properties, accuracy is expressed either as a percent recovery (R) or as a percent bias (R - 100). Accuracy is determined, in part, by analyzing data from LCSs, MS and MSD.

Accuracy and Precision objectives employed by the laboratory are as defined in the CERCLA's Inorganic and Organic Statements of Work (SOW); statistically-derived control limits; or default limits as listed in each respective method SOP.

4.4.3.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent a characteristic of a population, a variation in a physical or chemical property at a sampling point, or an environmental condition. Data representativeness is primarily a function of sampling strategy; therefore, the sampling scheme must be designed to maximize representativeness. Representativeness also relates to ensuring that, through sample homogeneity, the sample analysis result is representative of the constituent concentration in the sample matrix. STL makes every effort to analyze an aliquot that is representative of the original sample, and to ensure the homogeneity of the sample before sub-sampling.

4.4.3.4 Completeness

Completeness is defined as the percentage of measurements that are judged valid or useable. Factors negatively affecting completeness include the following: sample leakage or breakage in transit or during handling, loss of sample during laboratory analysis through accident or improper handling, improper documentation such that traceability is compromised, or sample result is rejected due to failure to conform to QC specifications. A completeness objective of greater than 90% of the data specified by the statement of work is the goal established for most projects.

4.4.3.5 Comparability

Comparability is a measure of the confidence with which one data set can be compared to another. To ensure comparability, all laboratory analysts are required to use uniform procedures (e.g., SOPs) and a uniform set of units and calculations for analyzing and reporting environmental data.

A measure of inter-laboratory comparability is obtained through the laboratory's participation in proficiency testing (PT) programs established with Water Supply (WS), Water Pollution (WP), Solid Waste (SW), and Underground Storage Tank (UST) programs. In addition, the laboratory employs the use of NIST or EPA traceable standards, when available, to provide an additional measure of assurance of the comparability of data.

Project representativeness and comparability are dependent upon the sampling plan on a project specific basis, and are therefore not covered in this LQM. Assessment of site and collection representativeness and comparability is performed by the field engineer.

4.4.3.6 Additional DQOs

Method Detection Limits

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to Appendix B of 40 CFR 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants". MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually. *(UQA-017)*

For the performance of non-routine methods, e.g., client/contract requirement, MDLs or Method Validation Studies will be completed on an as needed basis. The turnaround time for such studies will be as determined by the client and Project Manager. Such studies will be reviewed and approved by the client and/or regulatory agency prior to project implementation.

Instrument Detection Limits

There are a number of ways to determine Instrument Detection Limit (IDL) sensitivity (e.g., signal-to-noise ratio; precision of the low-level standard; lowest calibration curve point or the IDL study defined within CLP). The method and means in which IDLs are determined are documented and maintained in the QA department for each individual instrument.

IDLs are generated for each element by the metals laboratory quarterly via each instrument as specified in CLP. These limits are used to gauge instrument sensitivity and when routinely evaluated, instrument performance without the introduction of method variance can be determined. *(UQA-010)*

Reporting Limits

Reporting Limits are defined as the lowest concentration of an analyte determined by a given method in a given matrix that the laboratory feels can be reported with acceptable quantitative error or client requirements, values specified by the EPA methods or other project and client requirements. The laboratory reporting limits are further related and verified by the lowest point on a calibration curve. Because of the high level of quantitative error associated with determinations at the level of the MDL, the laboratory maintains reporting limits higher than the MDL. Wherever possible, reporting is limited to values approximately 2-5x the respective MDL to ensure confidence in the value reported. Client specific requests for reporting to the IDL or MDL are special circumstances not to be confused with the previous statement. Data evaluated down to the MDL/IDL is qualified as estimated with a 'J' for organic analyses and a 'B' for inorganic analyses on the data report.

MDL studies are performed annually, and reporting limits are assessed. If the MDL does not meet the routine laboratory reporting limit or the method specified limit, it is repeated or the laboratory reporting limit is reassessed. If the laboratory continually demonstrates that the method reporting limits are not achieved, equipment, technique, and the method are reviewed to assure optimal performance or appropriate action is taken.

4.5 Subcontracting

Subcontracting is arranged with the documented consent of the client, in a timely response which shall not be unreasonably refused. All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Proof of holding required certifications from the subcontract facility are maintained in the project records. Where applicable, the specific QC guidelines, QAPPs, and/or SAPs are transmitted to the subcontract laboratory. Samples are subcontracted under formal Chain of Custody (COC).

Subcontract laboratories may receive an on-site audit by a representative of STL's QA staff if it is deemed appropriate by the QA Manager. The audit involves a measure of compliance with the required test method, QC requirements, as well as any special client requirements (e.g., Technical Profile and LabNet Project Notes). STL may also perform a paper audit of the subcontractor, which would entail reviewing the LQM, the last two PT studies, and a copy of any recent regulatory audits with the laboratory's responses.

Intra-company subcontracting may also occur between STL facilities. Intra-company subcontracting within STL is arranged with the documented consent of the client (e.g., QAPP). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. STL has implemented a standard form for Intra-laboratory subcontracting, refer to the following document for specific details: *Work Sharing Process – Policy No.: S-C-001.*

Project reports from both STL and external subcontractors are not altered and are included in their original form in the final project report provided by STL. This clearly identifies the data as being produced by a subcontractor facility. All data, as required in Section 5.9.4, is included.

4.6 Purchasing Services and Supplies

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specific requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff.

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Purchasing guidelines for equipment and reagents meet with the requirements of the specific method and testing procedures for which they are being purchased. The measurements for evaluation and selection of suppliers; the acceptance of supplies and services; and certificates of conformance are described in the procurement SOP (*Procurement Quality Assurance Process*; UQA-020).

4.6.1 Solvent and Acid Lot Verification

Pre-purchase approval is performed for solvents and acids purchased in large quantities unless a certificate of conformance has been furnished. These may include acetone, ethyl ether, hexane, methylene chloride, nitric acid, hydrochloric acid, sulfuric acid, and hydrogen peroxide. Each lot of incoming supplies requiring pre-approval is checked against the previously approved lot number. If the lot number is not approved, the lot is refused. If the lot number is an approved lot number, it is accepted and documented. Solvents and acids are pre-tested in accordance with STLs Corporate *Testing Solvents and Acids* procedure (S-T-001) for all of the STL laboratories.

4.7 Service to the Client

4.7.1 Sample Acceptance Policy

Samples are considered "compromised" if the following conditions are observed upon sample receipt:

- Cooler and/or samples are received outside of temperature specification.
- Samples are received broken or leaking.
- Samples are received beyond holding time.
- Samples are received without appropriate preservation.
- Samples are received in inappropriate containers.
- COC does not match samples received.
- COC is not properly completed or not received.
- Breakage of any Custody Seal.
- Apparent tampering with cooler and/or samples.
- Headspace in volatiles samples.
- Seepage of extraneous water or materials into samples.
- Inadequate sample volume.
- Illegible, impermanent, or non-unique sample labeling.

When "compromised" samples are received, it is documented on the hardcopy COC, the LabNet Sample Receipt Checklist and on a Sample Discrepancy Report (SDR); and the client is contacted for instructions. If the client decides to proceed with the analysis, the project report will clearly indicate any of the above conditions and the resolution.

4.7.2 Client Confidentiality and Proprietary Rights

Data and sample materials provided by the client or at the client's request, and the results obtained by STL, shall be held in confidence (unless such information is generally available to the public or is in the public domain or client has failed to pay STL for all services rendered or is otherwise in breach of the terms and conditions set forth in the STL and client contract) subject to any disclosure required by law or legal process. Technical, business and proprietary information provided by a client and data/information generated by the laboratory are restricted for the use within the laboratory for purposes of accomplishing the project. Client information is not to be used on other projects or revealed except in conjunction with project work to anyone outside the laboratory without permission of the client.

STL's reports, and the data and information provided therein, are for the exclusive use and benefit of client, and are not released to a third party without written consent from the client (*Client Confidentiality*; UQA-004).

4.8 Complaints

STL believes that effective client complaint handling processes have important business and strategic value. Listening to and documenting client's concerns captures 'client knowledge' that helps to continually improve processes and outpace the competition. Implementing a client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly. The investigation of the cause, resolution and authorization of corrective action is documented [*Sample Discrepancy Report (SDR), Resubmitted Data Request (RDR), Corrective Action Report (CAR)*; UQA-029].

Client complaints are documented by the employee receiving the complaint. The documentation can take the form of a Resubmitted Data Request (RDR) or in a format specifically designed for that purpose (e.g., phone conversation record or e-mail). The Laboratory Director, Project Manager and/or QA Manager are informed of client complaints and assist in resolving the complaint.

The RDR is used after the client has received the analytical report and their specifications, expectations, or client satisfaction was not achieved. RDRs are prepared when clients request re-evaluation of submitted data, when additional information is requested or for general complaints.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA department is required to conduct a special audit to assist in resolving the issue. A written confirmation, or letter to the client outlining the issue and response taken, is strongly recommended as part of the overall action taken.

The number and nature of client complaints is reported by the QA Manager to the QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the *Quality Systems Management Review* (UQA-002).

4.9 Control of Non-conformances

Non-conformances include any out of control occurrence. Non-conformances may relate to client specific requirements, procedural requirements, or equipment issues. All non-conformances in the laboratory are documented at the time of their occurrence on Corrective Action Reports (CARs) specifically formatted for each department or on a SDR.

All non-conformances that affect a sample and/or sample data become part of the affected project's permanent record. When appropriate, reanalysis is performed where QC data falls outside of specifications, or where data appears anomalous. If the reanalysis comes back within established tolerances, the results are approved. If the reanalysis is still outside tolerances, further reanalysis or consultation with the Section Manager, Project Manager or QA Manager for direction may be required. All records of reanalysis are kept with the project files.

Where non-conformances specifically affect a client's sample and/or data, the client is informed and action must be taken. Action can take the form of reporting and flagging the data, and including a description of the non-conformance in the project narrative.

4.10 Corrective Action

To consistently achieve technical and regulatory requirements, the laboratory data must be supported by an effective corrective action system. The system must be capable of isolating and rectifying both random and systematic errors. Identification of systematic errors, or errors that are likely to occur repetitively due to a defect or weakness in a system, is particularly valuable in maintaining an environment of continuous improvement in laboratory operations.

Mechanisms used to ensure problem definition include SOPs; internal and external audits and surveillances; and regular laboratory management meetings. When evaluation of performance against established criteria for good laboratory practices shows a condition that could adversely affect the quality of services provided, corrective action is initiated.

Any employee in STL can initiate a corrective action. The initial source of corrective action can also be external to STL (i.e., corrective action due to client complaint, regulatory audit, or PT(s)). When a problem that requires corrective action is identified, the following items are identified by the initiator on the corrective action report: the nature of the problem, the name of the initiator, and the date. If the problem affects a specific client project, the PM is informed immediately.

All corrective actions, whether immediate or long-term, will comprise the following steps to ensure a closed-loop corrective action process:

- Define the problem.
- Assign responsibility for investigating the problem.
- Determine a corrective action to eliminate the problem.
- Assign, and obtain commitment to, responsibility for implementing the corrective action.
- Implement the correction.
- Assess the effectiveness of the corrective action and verify that the corrective action has eliminated the problem.

4.10.1 Immediate Corrective Action

Immediate corrective actions to correct or repair non-conforming equipment and systems are generally initiated in response to adverse conditions identified through QC procedures. The analyst has relatively quick feedback that a problem exists, e.g., calibration does not meet or QC check samples exceed allowable criteria, and can take immediate action to repair the system.

The initial responsibility to monitor the quality of a function or analytical system lies with the individual performing the task or procedure. DQOs are evaluated against laboratory-established or against method or client specified QA/QC requirements. If the assessment reveals that any of the QC acceptance criteria are not met, the analyst must immediately assess the analytical system to correct the problem. When the appropriate corrective action measures have been defined and the analytical system is determined to be "in-control" or the measures required to put the system "in-control" have been identified and scheduled, the problem and resolution or planned action is documented in the appropriate logbook or CAR. Data generated by an analytical system that is determined to be out-of-control must never be released without approval of the Section Manager, QA Manager, Laboratory Director, Project Manager and client notification.

When an acceptable resolution cannot be met or data quality is negatively affected, the analyst will notify their Section Manager and initiate an SDR. If an SDR is required, it is routed for proper authorizations and direction. Proper authorization and direction is given by the Project Manager and/or QA Manager. Based upon the circumstances and judgment of the Project Manager, the client may be notified of the situation.

Data generated concurrently with an out-of-control system will be evaluated for usability in light of the nature of the deficiency. If the deficiency does not impair the usability of the results, data will be reported and the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by a written SDR and appropriate corrective action (e.g., reanalysis) is taken and documented.

A CAR documents analytical problems at the bench level. This form allows for the documentation of the out-of-control situation, actions undertaken to correct the problem and a return-to-control status. All CARs are signed/dated by the respective laboratory Section Manager.

The QA Manager has the authority to stop the analysis, e.g., failure to meet method or project requirements, and to hold all analyses of samples affected by an out-of-control situation. The method cannot be restarted without appropriate documentation leading to the QA Manager's approval and sign-off.

4.10.2 Long-term Corrective Action

Long-term corrective action is generally initiated due to QA issues, which are most often identified during internal and external audits (Sections 4.13 & 4.14). Typically, a deeper investigation into the root cause of the nonconformance is warranted, and the problem may take much longer to identify and resolve. Staff training, method revision, replacement of equipment, and LabNet reprogramming are examples of long-term corrective action.

4.10.3 Responsibility and Closure

The Section Manager is responsible for correcting out-of-control situations, placing highest priority on this endeavor. Associated corrective actions, once verified for effectiveness, are incorporated into standard practices. Ineffective actions will be re-evaluated until acceptable resolution is achieved. Section Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved.

The QA Department also may implement a special audit (Section 4.13). The purpose of inclusion of the corrective action process in both routine and special audits is to monitor the implementation of the corrective action and to determine whether the action taken has been effective in overcoming the issue identified.
Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation. This provides laboratory QA personnel non-laboratory management support, if needed, to ensure that QA policies and procedures are enforced.

4.11 Preventative Action

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive continuous process improvement activity which can be initiated by clients, employees, business providers, and affiliates. The QA section has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Preventive action opportunities may be identified from information obtained through activities related to but not limited to the corrective action process, performance evaluation program, internal audits, management review, and/or market trends, industry trends and competitive comparisons.

Established standard practices for preventive action are included in the *Preventive Action Measures* SOP (UQA-019); the *SDR / RDR / CAR* SOP (UQA-029) and the *Quality System Management Review* SOP (UQA-002). These procedures describe the information sources used to detect, analyze, and eliminate potential causes of nonconformities and to ensure effective implementation of solutions.

4.12 Records

4.12.1 Record Types

Record types are described in Table 4.

4.12.2 Record Retention

Data reports are filed electronically as .pdf files by sample job number. Hardcopy COC files are maintained and are filed in Job Number order.
Laboratory data, project management files, QA records (e.g., PT scores/corrective actions; MDLs/IDLs, statistical analysis, QAPPs, etc.), Human Resources information, etc.., are compiled by date order. The same procedure is followed both in current and archived hardcopy storage.

Upon archiving, a *Records Management Form* (CHI-22-05-032) is prepared for each storage box of records. This form documents the department, department manager, contents (description and dates), term of retention (e.g., no. of years) and an assigned identification number. The original of this form is maintained with the data management department with a carbon copy filed within the storage box. Upon purging of records, the individual department managers sign the original form as confirmation for the destruction of the associated data. This signature indicates that the laboratory has maintained the information for the required amount of time and is no longer required to store it.
Table 5 outlines the laboratory's standard record retention time. For raw data and project records, record retention is calculated from the date the project report is issued. For other records, such as Controlled Documents, QC, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 6 have lengthier retention requirements and are subject to the requirements in Section 4.12.3.

Table 4. STL Record Types

Raw Data	Controlled Documents	QC Records	Project Records	Administrative Records
See Section 3. Terms and Definitions	LQMs/ QAPPs	Audits/ Responses	COC Documentation	Accounting
	QMP (Corporate)	Certifications	Contracts and Amendments	Corporate Safety Manual, Permits, Disposal Records
	SOPs	SDRs/RDRs	Correspondence	Employee Handbook
		Logbooks*	QAPP	Personnel files, Employee Signature & Initials, Training Records
		Method & Software Validation, Verification	SAP	
		Standards Certificates	Telephone Logbooks	Technical and Administrative Policies
	Work Instructions	MDL/IDL/IDC Studies	E-mails	
		PTs	Electronic Data Report	
		Statistical Evaluations		

*Examples of Logbook types: Maintenance, Instrument, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, and Balance Calibration.

Table 5. STL Record Retention

Record Type		Archival Requirement *
Raw Data	All* (Electronic Data Reports (.pdf & EDD)	5 Years from completion
Controlled Documents	All*	5 Years from document retirement date
QC	All*	5 Years from archival
Project	All*	5 Years from project completion
Administrative	Personnel/Training	Indefinitely
	Accounting	10 years

* Exceptions listed in Table 6.

4.12.3 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the laboratory's standard record retention time. These are detailed in Table 6 with their retention requirements and client-specific requirements are listed in the *Record Retention and Purging* SOP (UDM-002). In these cases, the longer retention requirement is implemented and noted in the archive. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 6. Special Record Retention Requirements

Program	Retention Requirement
Colorado – Drinking Water	10 years
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Massachusetts – Drinking Water	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Minnesota – Drinking Water	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
OSHA - 40 CFR Part 1910	30 years
Pennsylvania – Drinking Water	10 years
TSCA – 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

4.12.4 Archives and Record Transfer

Archives are indexed such that records are accessible on either a project or temporal basis. Archives are protected against fire, theft, loss, deterioration, and vermin. Electronic records are protected from deterioration caused by magnetic fields and/or electronic deterioration. Access to archives is controlled and documented.

STL ensures that all records are maintained as required by the regulatory guidelines and per this LQM upon facility location change or ownership transfer. Upon facility location change, all archives are retained by STL in accordance with this LQM. Upon ownership transfer, all final test reports generated by the laboratory will be submitted to the clients if not previously provided. Any further record retention requirements will be addressed in the ownership transfer agreement and the responsibility for maintaining archives will be clearly established.

In the event that the laboratory is closed, all final test reports generated by the laboratory will be submitted to the clients if not previously provided. All records will then be transferred to STL's corporate record storage location. All boxes and contents will be appropriately labeled with the dates of destruction (Refer to Tables 5 and 6) and managed in accordance their policies.

4.13 Internal Audits

Quality assurance audits and surveillances are conducted to assess the performance of laboratory systems in meeting technical, regulatory and client requirements; and to evaluate the operational details of the QA program (*Internal Audits*; UQA-013). They provide a means for management to be apprised of, and to respond to, a potential problem before it actually impacts the laboratory operations. They also are a mechanism for ensuring closure of corrective actions resulting from external audits.

4.13.1 Audit Types and Frequency

A number of types of audits are performed at STL. These audit types and frequency are categorized in Table 7.

Table 7. Audit Types and Frequency

Audit Type	Performed by	Frequency
Systems	QA Department or Designee	Annual
Data Authenticity	QA Department or Designee	**Data Report Review:** As necessary to ensure an effective secondary review process and to meet special program independent review objectives
		Analyst Data Audits: 100% of all analysts annually
Electronic		**Electronic Data Audits:** 100% of all organic instruments
Special	QA Department or Designee	As Needed

4.13.2 Systems Audits

Systems audits are technical in nature and are conducted on an ongoing basis by the QA Manager or the QA Specialist. Systems audits cover all departments of the facility, both operational and support. The review consists of laboratory systems, procedures, documentation and issues noted in external audits.

The audit report is issued by the QA Manager or QA Specialist within 21 calendar days of the audit. The audit report is addressed to the department Section Manager and copied to the QA department and the Laboratory Director.

Written audit responses are required within 30 calendar days of the audit report issue. A maximum of one calendar month is given to address any recommended corrective actions. The audit response is directed to all individuals copied on the audit report. Where a corrective action may require longer than a calendar month to complete, the target date for the corrective action implementation is stated and evidence of the corrective action is submitted to the QA Department in the agreed upon time frame.

4.13.3 Data Audits

Data audits are focused to assess the level of customer service, SOP compliance, regulatory compliance, accuracy and completeness of test results and reports, documentation, and adherence to established QC criteria, laboratory SOPs, technical policy, and project specific QC criteria.

The QA Department provides feedback and/or corrections and revisions to project reports where necessary. Records of the data audits are kept, and the frequency of data audits is included in the monthly QA report. In performing data audits, it is essential that data be assessed in terms of differentiating between systematic and isolated errors. Upon noting anomalous data or occurrences in the data audits, the QA Department is responsible for seeking clarification from the appropriate personnel, ascertaining whether the error is systematic or an isolated error, and overseeing correction and/or revision of the project report if necessary. Errors found in client project reports are revised and the revision sent to the client (Section 4.8). The QA Department is also responsible for assisting in the corrective action process where a data audit leads to identification of the need for permanent corrective action.

The frequency of data auditing may also be dependent upon specific clients and regulatory programs. All active laboratory logbooks and QC files are subject to periodic audits/ surveillances by the QA personnel.

4.13.3.1 Data Authenticity Audits

Data authenticity audits shall be performed on 100% of all analysts by the QA department or a designee independent from laboratory operations. Performing data authenticity checks will typically include verifying raw data, evaluating calculation tools and independently reproducing the final results and comparing it to the hardcopy on randomly selected batches of data. The QA Manager will report the percentage of analysts reviewed (for the year) in the monthly QA report and should average about 8% per month.

4.13.3.2 Electronic Data Audits

Electronic data audits are performed on 100% of all organic instruments by the QA department or a designee independent from the operations. This may include Mint Miner® scanning of randomly selected batches of electronic data followed by a chromatography system review. The QA manager will report the percentage of instruments reviewed (for the year) in the monthly QA report and should average about 8% of instruments per month. Electronic data audits include spot-checking of manual integrations by QA personnel in order to determine that the manual integration is appropriate and documented according to Section 5.3.6.1.

4.13.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, proficiency testing results, data audits, systems audits, validation comments, or regulatory audits. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

4.14 External Audits

STL is routinely audited by clients and external regulatory authorities – both government and non-government. Whether the audit is scheduled or unannounced, full cooperation with the audit team is provided by the laboratory and administrative staff. STL recommends that the audits be scheduled with the QA Department so that all necessary personnel are available on the day of the audit.

4.15 Management Reviews

4.15.1 QA Reports to Management

A monthly QA report is prepared by QA Manager and forwarded to the Laboratory Director, Project Managers, Section (Technical) Managers and the Corporate Quality Director. The reports include statistical results that are used to assess the effectiveness of the quality system. The format of the monthly report is shown in Figure 3.

4.15.2 Quality Systems Management Review

A quality systems management review is performed at least annually by the QA Manager. This review ensures that the laboratory's quality system is adequate to satisfy the laboratory's policies and practices, government requirements, certification, accreditation, approval requirements, and client expectations. Quality systems management reviews are accomplished through the evaluation and revision of this LQM, monthly quality assurance reporting and goal setting.

Management reviews of specific quality system elements may be performed through continuous improvement activities, monthly QA reports, process changes, SOP revisions, and/or audit reports/responses. Documentation of these reviews are not required unless it is inherent in the review mechanism (e.g., approval signatures on SOP revisions).

4.15.3 Monthly QA Report and Metrics

By the 3rd day of the month, the QA manager prepares a monthly QA report. The report is sent to the Laboratory Director and Corporate Quality Director. The report contains a narrative summary and metrics spreadsheet. At a minimum, the report content contains the items listed below (Figure 3). During the course of the year, the Laboratory Director, General Manager or Corporate Quality Director may request that additional information be added to the report.

Figure 3. Monthly QA Report Format

1	Audits
	External System Audits Internal System Audits Internal Training Record Audits Internal Data Audits
2	Revised Reports / Client Complaints / Client Compliments
	Revised Reports (RDR) Client Complaints Client Compliments
3	Certification Changes
	Certification Status Losses / Revocations
4	Proficiency Testing
	Study participation PT scores PT failures History of failures
5	SOP Status
	SOPs totals summarized by manager On-Time percentages calculated for SOPs < 1 year
6	Project/QAPP Review Status
7	Holding Time Violations
8	Monthly QA Report Metrics
	Summarize metrics in template provided by the Corporate Quality Director

5.0 Technical Requirements

5.1 Personnel

5.1.1 General

STL management believes that its highly qualified and professional staff is the single most important aspect in assuring the highest level of data quality and service in the industry. The staff consists of professionals and support personnel that include the following positions:

- Laboratory Director
- QA Manager
- Health & Safety Coordinator / Waste Management
- Project Manager
- Information Technology Manager
- Department Section Manager (Technical Manager)
- Analyst
- Sample Custodian
- Technician
- Quality Assurance Specialist
- Data Review Specialist

In order to ensure that employees have sufficient education and experience to perform a particular task, job descriptions are developed for all personnel (Section 4.1.2).

5.1.2 Training

STL is committed to furthering the professional and technical development of employees at all levels. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for STL employees are outlined in Table 8.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. The QA department, in conjunction with the Human Resources coordinator and Section Supervisor are responsible for maintaining the documentation of these activities.

Each laboratory section maintains documentation associated with analytical training (e.g., training records, document control). The QA department maintains documentation of initial and continued method proficiency for laboratory instrumentation and for each analyst. This documentation is represented in the following forms: MDLs, IDMPs, IDOCs, CDOCs, PT Sample results, Instrument QC and Batch QC Control Charts. This information is available to managers and staff for planning and evaluation.

The Human Resource coordinator maintains documentation and attestation forms on employment status & records; benefit programs; time keeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

The following evidence items are on file for each technical employee:

- Initial Demonstration of Capability (IDOC) for each method.
- Attestation that the employee has read and understood the latest version of the laboratory's quality documentation.
- The employee has read and understood the latest, approved version of all test methods and/or SOPs for which the employee is responsible.
- Annual evidence of Continued Demonstration of Capability (CDOC) that may include, but is not limited to, successful analysis of a blind sample on the specific test method or a similar test method; an annual DOC of four successive and acceptable LCSs.
- An Ethics Agreement signed by each staff member (renewed each year).
- A Confidentiality Agreement signed by each staff member (renewed each year).

Table 8. STL Employee Minimum Training Requirements

Specialty	Experience
General Chemistry and Instrumentation	Six months
Gas Chromatography	One year
Atomic Absorption	One year
Mass Spectrometry	One year
Spectra Interpretation	Two years

Required Training	Time Frame [1]	Employee Type
Environmental Health & Safety	Month 1	All
Ethics – Corporate Overview	Week 1	All
Ethics	Month 1	All
Data Integrity	Month 1	Technical and PMs
Ethics Refresher	Annually	All
Quality Assurance	Quarter 1	All
Initial Demonstration of Capability (IDOC)	Prior to unsupervised method Performance	Technical

[1] From the date of initial employment unless otherwise indicated.

The quality assurance training includes an overview of regulatory programs and program goals, a review of the ethics statement, and group discussions about data integrity and data misrepresentation.

When an analyst does not meet these requirements, they can perform a task under the supervision of a qualified analyst, peer reviewer or section manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

IDOCs (Initial Demonstration of Method Capability) are performed by the analysis of four replicate QC samples. Results of successive LCS analyses can be used to fulfill the IDOC requirement, however, LCSs performed over several batches is desirable. The accuracy and precision, measured as average recovery and standard deviation (using n-1 as the population), of the 4 replicate results are calculated and compared to those in the test method (where available). If the test method does not include accuracy and precision requirements, the results are compared to target criteria set by the laboratory. The laboratory sets the target criteria such that they reflect the DQOs of the specific test method or project. An IDOC Certification Statement is recorded and maintained in the employee's training file. Tabulated results summary and raw data are completed and signed by the analyst and section manager with the proper entries made onto the analysts training record. The data is submitted to the QA department for approval and entry into the master IDOC spreadsheet and for filing. Figure 4 shows an example of an *IDOC Certification Statement*. (CHI-22-09-271)

On an annual basis, the analyst's method capabilities must be evaluated. The requirement that a CDOC (Continued Demonstration of Capability) be completed for each method currently being analyzed must be presented for approval to the QA department. (e.g. *Yearly Method Capability Review Work Instruction-Wet Chemistry*: CHI-22-09-279)

Further details of the laboratory's training program are described in the Laboratory Training SOP (UQA-014).

Figure 4. Demonstration of Capability Certification Statement

Demonstration of Capability
Certification Statement

Date:
STL Chicago
2417 Bond Street
University Park, IL 60466

Analyst Name:____________________
SOP No.:____________________
Method No.:____________________
Description:____________________
Matrix:____________________
Effective Date:____________________

We the undersigned certify that:

1. The analyst identified above, using the cited test method(s), which is in use at this laboratory for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Demonstration of Capability.
2. The test method(s) was performed by the analyst identified on this certification.
3. A copy of the reference method and laboratory-specific SOP(s) are available for all personnel on-site.
4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory.
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the laboratory, and that the associated information is well organized and available for review by authorized assessors.

Technical Manager	Signature	Date	
Quality Assurance Manager	Signature	Date	

5.1.3 Ethics Policy

Establishing and maintaining a high ethical standard is an important element of a Quality System. In order to ensure that all personnel understand the importance the company places on maintaining high ethical standards at all times; STL has established an Ethics Policy (P-L-006) and an Ethics Agreement (Figure 5). Each employee signs the Ethics Agreement, signifying agreed compliance with its stated purpose on an annual basis.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize the Company's ability to do work on Government contracts, and for that reason, the Company has a Zero Tolerance approach to such violations.

Ethics is also a major component of STL's quality and data integrity systems. Each employee is trained in ethics within thirty days of hire and quality training within three months of hire. Annual ethics refresher training will be provided. Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. A data integrity hotline is maintained by STL and administered by the Corporate Quality Director.

Figure 5. STL Ethics Agreement

I understand that STL is committed to ensuring the highest standard of quality and integrity of the data and services provided to our clients. I have read the Ethics Policy of the Company.

With regard to the duties I perform and the data I report in connection with my employment at the Company, I agree that:

- I will not intentionally report data values that are not the actual values obtained;
- I will not intentionally report the dates, times, sample or QC identification, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations;
- I will not intentionally misrepresent another individual's work;
- I will not intentionally report data values that do not meet established quality control criteria as set forth in the Method and/or Standard Operating Procedures, or as defined by Company Policy;
- I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner; and I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees; and
- If a supervisor or a member of STL management requests me to engage in or perform an activity that I feel is compromising data validity or quality, I will not comply with the request and report this action immediately to a member of senior management, up to and including the President of STL.

As a STL employee, I understand that I have the responsibility to conduct myself with integrity in accordance with the ethical standards described in the Ethics Policy. I will also report any information relating to possible kickbacks or violations of the Procurement Integrity Act, or other questionable conduct in the course of sales or purchasing activities. I will not knowingly participate in any such activity and will report any actual or suspected violation of this policy to management.

The Ethics Policy has been explained to me by my supervisor or at a training session, and I have had the opportunity to ask questions if I did not understand any part of it. I understand that any violation of this policy subjects me to disciplinary action, which can include termination. In addition, I understand that any violation of this policy which relates to work under a government contact or subcontract could also subject me to the potential for prosecution under federal law.

EMPLOYEE SIGNATURE:____________________ Date: ____________
Supervisor/Trainer:____________________ Date:____________

5.2 Facilities

The laboratory is a secure facility with controlled and documented access. Access is controlled by various measures including locked doors, electronic access cards, security codes, and a staffed reception area. All visitors sign in and are escorted by STL personnel while at the facility. The laboratory is locked at all times, unless a receptionist is present to monitor building access (e.g., between the hours of 8:00 a.m. and 5:00 p.m. Monday through Friday).

The facility is designed for efficient, automated high-quality operations. The laboratory is equipped with Heating, Ventilation, and Air Conditioning (HVAC) systems appropriate to the needs of environmental testing laboratories. Environmental conditions in the facility, such as hood flow, are routinely monitored and documented.

The facility is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. STL also provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc..

5.3 Test Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices.

5.3.1 Method Selection

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager in a Technical Profile and within LabNets Project Notes feature. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists, etc..), the method of choice is selected based on client needs and available technology.

Most of the test methods performed at STL originate from test methods published by a regulatory agency such as the US EPA and other state and federal regulatory agencies. These include, but are not limited to, the following published compendiums of test methods. A listing of methods in which the laboratory is capable of performing is listed in laboratory's *Methods Capabilities* Work Instruction (CHI-22-09-255).

Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water.

Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM); Non-polar Material) by Extraction and Gravimetry, EPA-821-R-98-003, February 1999.

Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.

Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.

Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.

NIOSH Manual of Analytical Methods, 4th ed., August 1994.

Statement of Work for Inorganics Analysis, ILM04.0, USEPA Contract Laboratory Program Multi-media, Multi-concentration.

Statement of Work for Organics Analysis, OLM04.2 and OLC02.1, USEPA Contract Laboratory Program, Multi-media, Multi-concentration.

Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.

Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW-846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996.

Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc.., and establishes an implementation schedule. As such, the laboratory strives to perform only the latest versions of each approved method.

5.3.2 SOPs

STL maintains an *Approved SOP Listing* (CHI-22-09-SOP) for both Method and Process SOPs. Method SOPs are maintained to describe a specific test method. Process SOPs are maintained to describe function and processes not related to a analytical testing (e.g., administrative procedures).

Method SOPs contain the following information:

Title Page with Document Name, Document Number, Revision Number, Effective Date, Page Numbers and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 6).

1. Identification of Test Method
2. Applicable Matrix
3. Scope and Application, including test analytes
4. Summary of the Test Method
5. Reporting Limits
6. Definitions
7. Interferences
8. Safety
9. Equipment and Supplies
10. Reagents and Standards
11. Sample Collection, Preservation and Storage
12. Quality Control
13. Calibration and Standardization
14. Procedure
15. Calculations
16. Method Performance
17. Pollution Prevention
18. Data Assessment and Acceptance Criteria for Quality Control Measures
19. Corrective Actions for Out-of-Control Data
20. Contingencies for Handling Out-of-Control or Unacceptable Data
21. Waste Management
22. References
23. Tables, Diagrams, Flowcharts and Validation Data

Process SOPs contain the following information:

Title Page with Document Name, Document Number, Revision Number, Effective Date, Page Numbers and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 6).

1. Scope
2. Summary
3. Definitions
4. Responsibilities
5. Procedure
6. References
7. Tables, Diagrams, and Flowcharts

The QA Department is responsible for maintenance of SOPs, archival of SOP historical revisions, maintenance of an SOP index, and records of controlled distribution. SOPs, at a minimum, undergo annual review (12-18 months). Where an SOP is based on a published method, the laboratory maintains a copy of the reference method.

Figure 6. Proprietary Information Statement

SOP Change Form

The SOP Change Form is used for implementation, documentation, and authorization of changes to SOPs (*SOP Change Protocol*; UQA-032). Immediate changes in SOPs may be necessary to accommodate improvements; to implement acceptable changes in practices; or to correct potential errors in the existing version. The reason for the change will be identified and a detailed description of the procedure change will be presented. Since this form will become part of the referenced SOP, until such time that the SOP is updated, it must be legible and comprehensible. The Change Form must provide an exact description and identify the affected sections.

Once this form is completed and changes are authorized, it becomes an official part of the SOP for which it revises, and is subject to all document control and records management policies.

5.3.3 Method Validation

Laboratory developed methods are validated and documented according to the procedure described in Section 5.3.5.

5.3.4 Method Verification

Method verification is required when a validated standard test method or a method modification is implemented. The level of activity required for method verification is dependent on the type of method being implemented, or on the level of method modification and its affect on a method's robustness. Method modification often takes advantage of a method's robustness, or the ability to make minor changes in a method without affecting the method's outcome.

It is the responsibility of the section manager to present to the QA manager all applicable method validation studies for review and approval. The documented approval by the section manager and QA manager must be applied to all applicable validation records before the method is released for use. Method verification may require some, but not all, of the activities described in Section 5.3.5.

5.3.5 Method Validation and Verification Activities

Before analyzing samples by a particular method, method validation and/or method verification must occur. A complete validation of the method is required for laboratory developed methods. While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

Determination of Method Selectivity
Method selectivity is demonstrated for the analyte(s) in the specific matrix or matrices. In some cases, to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

Determination of Method Sensitivity
Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed. The laboratory determines MDLs are described in Section 4.4.3.6 and within UQA-017 and the corporate procedure S-Q-003.

Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)
An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum level at which both the presence of an analyte and its concentration can be reliably determined. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

Determination of Interferences
A determination that the method is free from interferences in a blank matrix is performed.

Determination of Range
Where appropriate, a determination of the applicable range of the method may be performed. In most cases, range is determined and demonstrated by comparison of the response of an analyte in a curve to established or targeted criteria. The curve is used to establish the range of quantitation

and the lower and upper values of the curve represent upper and lower quantitation limits. Curves are not limited to linear relationships.

Demonstration of Capability
DOCs are performed prior to method performance.

Determination of Accuracy and Precision
Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

Documentation of Method
The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Appendix describing the specific differences in the new method is acceptable in place of a separate SOP.

Continued Demonstration of Method Performance
Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS and Method Blanks.

5.3.6 Data Reduction and Review

Analytical data are entered/downloaded directly into LabNet or recorded on pre-formatted bench sheets that are paginated and bound into laboratory logbooks. These logbooks are issued and controlled by the laboratory's QA Section. A unique document control code is assigned to each book to assure that chronological record keeping is maintained. Analytical data may be electronically stored as a secure .pdf file to which the analyst applies an electronic signature.

Analytical data is referenced to a unique sample identification number for internal tracking and reporting. Both LabNet entries and logbook pages contain the following information, as applicable: analytical method, analyst, date, sequential page number, associated sample numbers, standard concentrations, instrument settings, and raw data. Entries are in chronological order and maintained so as to enable reconstruction of the analytical sequence.

The analyst is responsible for entering / recording all appropriate information, and for signing and dating all logbook entries daily. All entries and logbook pages are reviewed for completeness by a supervisor, peer reviewer or the analyst themselves. Data review checklists document the analytical review of the LabNet entries, logbook and associated QC indicators. Copies of instrument outputs (chromatograms, mass spectra, etc..) are maintained on file or electronically with the analyst's signature/initials and date.

5.3.6.1 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the section manager or alternate analyst prior to updating the data in LabNet. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the STL Corporate SOP entitled *Acceptable Manual Integration Practices* (S-Q-004).

Copies of all raw data and the calculations used to generate the final results, such as bound logbooks, are retained on file for a minimum of 5 years or as otherwise requested by the client/project.

Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

5.3.6.2 Data Review

All data, regardless of regulatory program or level of reporting, are subject to a thorough review process. The individual analyst continually reviews the quality of the data through calibration checks, quality control sample results and performance evaluation samples. Data review is initiated by the analyst during, immediately following, and after the completed analysis.

All levels of the review are documented on Data Review Checklists that are specific to each laboratory section.

GC Extractables/HPLC:	CHI-22-17-034
GC Volatiles:	CHI-22-19-003
GC/MS Volatiles and Semivolatiles:	CHI-22-20-038
Metals:	CHI-22-14-004, CHI-22-14-005, CHI-22-14-006
Wet Chemistry:	CHI-22-12-014

Primary Review

The primary review is often referred to as a "bench-level" review. In most cases, the analyst who generates the data (e.g., logs in, prepares and/or analyzes the samples) is the primary reviewer. In some cases, an analyst may be reducing data for samples run by an auto-sampler set up by a different analyst. In this case, the identity of both the analyst and the primary reviewer is identified in the raw data.

One of the most important aspects of primary review is to make sure that the test instructions are clear, and that all project specific requirements have been understood and followed.

Once an analysis is complete, the primary reviewer ensures, where applicable, that:

- Sample preparation information is complete, accurate, and documented.
- Calculations have been performed correctly.
- Quantitation has been performed accurately.
- Qualitative identifications are accurate.
- Manual integrations are appropriate.
- Data flags to indicate manual integrations are recorded.
- Manual integrations are authorized by a date and signature or initials of primary analyst.
- Client specific requirements have been followed.
- Method and process SOPs have been followed.
- Method QC criteria have been met.
- QC samples are within established limits.
- Dilution factors are correctly recorded and applied.
- Non-conformances and/or anomalous data have been properly documented and appropriately communicated.
- COC procedures have been followed.
- Primary review is documented by date and initials/signature of primary analyst.

Any anomalous results and/or non-conformances noted during the Primary Review are documented on the Data Review Checklist and on an SDR; and are communicated to the Section Manager and the Project Manager for resolution. Resolution can require sample reanalysis, or it may require that data be reported with a qualification. Non-conformances are documented per Section 4.9.

<u>Secondary Review</u>
The secondary review is also a complete technical review of a data and is performed by the Section Manager, analyst or data specialist. The secondary review is documented on the same Data Review Checklist as the primary review.

The following items are reviewed:

- Qualitative Identification
- Quantitative Accuracy
- Calibration
- QC Samples
- Method QC Criteria
- Adherence to method and process SOPs
- Accuracy of Final Client Reporting Forms
- Manual Integrations – Minimal requirement is to spot-check raw data files for manual integration, as verified by date and initials or signature of secondary data reviewer. Some regulatory programs require 100% secondary review of manual integrations.
- Completeness
- Special Requirements/Instructions

If problems are found during the secondary review, the reviewer must work with the appropriate personnel to resolve them. If changes are made to the data, such as alternate qualitative identifications, identifications of additional target analytes, re-quantitation, or re-integration, the secondary reviewer must contact the laboratory analyst and/or primary reviewer of the data so that the primary analyst and/or reviewer is aware of the appropriate reporting procedures.

Completeness Review
The completeness review includes the generation of a project narrative and/or cover letter which outlines anomalous data and non-compliances using project narrative notes and SDRs or CARs (non-compliance reports) generated during the primary and secondary review. The completeness review addresses the following items:

- Is the project report complete?
- Does the data meet with the client's expectations?
- Were the data quality objectives of the project met?

Are QC outages and/or non-conformances approved and appropriately explained in the narrative notes?

The laboratory Section Manager(s), Data Management personnel and the Project Manager contribute to the completeness review.

5.3.7 Data Integrity and Security

This section details those procedures that are relevant to computer systems that collect, analyze, and process raw instrumental data, and those that manage and report data.

Security and Traceability
Access to the laboratory's LabNet system, STL's proprietary LIMS, that collects, analyzes, and processes raw instrumental data, and those that manage and report data is both controlled and recorded. System users are granted access levels that are commensurate with their training and responsibilities.

Control of the system is accomplished through limitation of access to the system by users with the education, training and experience to perform the task knowledgeably and accurately. System users are granted privileges that are commensurate with their experience and responsibilities.

Computer access is tracked by using unique login names and passwords for all employees that have access to the computer system. Entries and changes are documented with the identity of the individual making the entry, and the time and date. Where a computer system is processing raw instrumental data, the instrument identification number as described in Section 5.4.1 is recorded. The system has the capability of maintaining audit trails to track entries and changes to the data. This function is activated on any computer system that has that capability (e.g., Target).

Verification
All the LabNet software programs have been verified prior to use and prior to the implementation of any version upgrades. Verification involves assessing whether the computer system accurately performs its intended function. Verification generally is accomplished by comparing the output of the program with the output of the raw data manually processed, or processed by the software being replaced. The verification of LabNet software programs are conducted by the QA manager with the assistance of the section managers and unit leaders. The QA manager documents the approval of the program verifications. All records of the verification are retained as QC records.

Validation
Software validation involves documentation of specifications and coding as well as verification of results. Software validation is performed by the QA manager on all in house programs. (LabNet) Records of validation include original specifications, identity of code, printout of code, software name, software version, name of individual writing the code, comparison of program output with specifications, and verification records as specified above. Records of validation are retained as QC records.

The QA manager must retain documentation of the validation process as defined above. The QA manager is the sole LabNet Methods Administrator at the laboratory and has the responsibility to validate any LabNet methods, calculations or criteria codes prior to use for sample analysis.

Auditing
STLs LabNet System Managers continually review the control, security, and tracking of IT systems and software.

Version Control
The laboratory maintains copies of outdated versions of software and associated manuals for all software in use at the laboratory for a period of 5 years from its retirement date. The associated hardware, required to operate the software, is also retained for the same time period.

5.4 Equipment

5.4.1 Equipment Operation

STL is committed to routinely updating and automating instrumentation. The laboratory maintains state of the art instrumentation to perform the analyses within the QC specifications of the test methods. The laboratory maintains an Equipment Tracking Form (CHI-22-09-068) for each piece of equipment and instrumentation that documents the following information:

- Identity
- Date In Service
- Manufacturer's Name, Model Number, Serial Number
- Current Location
- Preventative Maintenance Schedule

All equipment is subject to rigorous checks upon its receipt, upgrade, or modification to establish that the equipment meets with the selectivity, accuracy, and precision required by the test method for which it is to be used. All manufacturer's operations and maintenance manuals are kept up to date and accessible for the use of the equipment operator. Documentation of equipment usage is maintained using analytical run and maintenance logbooks.

5.4.2 Equipment Maintenance

STL employs a system of preventative maintenance in order to ensure system up time, minimize corrective maintenance costs and ensure data validity. All routine maintenance is performed as recommended by the manufacturer and may be performed by an analyst, instrument specialist or outside technician. Maintenance logbooks are kept on all major pieces of equipment in which both routine and non-routine maintenance is recorded.

Any item of equipment or instrumentation that has been subjected to overloading or mishandling, provides suspected results, has been shown by verification or otherwise to be defective, is new or not been used for an extended period of time, is taken out of services and tagged as "DO NOT USE INSTRUMENT". The tag is signed/dated by the person removing the item from service and noted as to the reason of in-operation *(Instrument and Equipment Out-of-Service Tagging*; UQA-012).

Any instrumentation that is brought back on-line must have MDLs and DOCs performed and have acceptance within prescribe criteria; or calibrated by a certified agency (e.g., balances or Class S weights) and tagged as being within calibration specifications; and proven to provide consistent measurements (e.g., refrigerators, eppendorf pipettes, ovens).

The return to analytical control following instrument repair is documented in the maintenance logbook. Maintenance logbooks are retained as QC records. Notation of the date and maintenance activity is recorded each time service procedures are performed. Maintenance logbooks are retained as QA records.

Table 9. Major Equipment Maintenance

Instrument	Procedure	Frequency
Hewlett Packard GC/MS	Ion gauge tube degassing Pump oil-level check Pump oil changing Analyzer bake-out Analyzer cleaning Resolution adjustment COMPUTER SYSTEM AND PRINTER: Air filter cleaning Change data system air filter Printer head carriage lubrication Paper sprocket cleaning Drive belt lubrication	As required Monthly Annually As required As required As required As required As required As required As required As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration Check carrier gas flow rate in column Check temp. of detector, inlet, column oven Septum replacement Check system for gas leaks with SNOOP Check for loose/frayed wires and insulation Bake injector/column Change/remove sections of guard column Replace connectors/liners Change/replace column(s)	Daily Daily via use of known compound retention Daily As required W/cylinder change as required Monthly As Required As Required As Required As Required
Electron Capture Detector (ECD)	Detector wipe test (Ni-63) Detector cleaning	Semi-annually As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Photoionization Detector (PID)	Change O-rings Clean lamp window	As required As required
HPLC	Change guard columns Change lamps Change pump seals Replace tubing Change fuses in power supply Filter all samples Change autosampler rotor/stator	As required As required Semi-annually or as required As required As required Daily As required
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily At least Annually
Conductivity Meter	0.01 M KCl calibration Conductivity cell cleaning	Daily As required
Turbidimeter	Check light bulb	Daily, when used

Maintenance contracts are held on specific pieces of equipment where outside service is efficient, cost-effective, and necessary for effective operation of the laboratory. Table 9 lists STL's major equipment and the suggested maintenance procedures.

Table 9. Major Equipment Maintenance

Instrument	Procedure	Frequency
AA (Graphite Furnace)	Clean lens and furnace head	Daily
	Replace windows	As required
	Check or change cuvette	Daily
	Check & drain compressor drain	Daily
	Clean atomizer cell/furnace hood	Daily
	Nebulizer cleaned/dried	Weekly or as required
	Check/change marble stones	Weekly
	Clean filters	Weekly
	Change graphite tube/platform	As required
	Empty waste container	Daily
	Remove carbon tube and check wear	Daily
	Check sample introduction probe	Daily
Leeman Mercury Analyzer	Check tubing for wear	Daily
	Fill rinse tank with 10% HCl	Daily
	Insert clean drying tube filled with Magnesium Perchlorate	Daily
	Fill reductant bottle with 10% Stannous Chloride	Daily
ICP	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check filters	Weekly
	Clean or replace filters	As required
	Check torch	Daily
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	Monthly
	Check entrance slit for debris	Monthly
	Change printer ribbon	As required
	Replace pump tubing	As required
UV-Vis Spectrophotometer	Clean ambient flow cell	As required
	Precision check/alignment of flow cell	As required
	Wavelength verification check	Semi-annually
Auto Analyzers	Clean sampler	Daily
	Check all tubing	Daily
	Clean inside of colorimeter	Daily
	Clean pump well and pump rollers	Quarterly
	Clean wash fluid receptacle	Weekly
	Oil rollers/chains/side rails	Weekly
	Clean optics and cells	Quarterly

Table 9. Major Equipment Maintenance

Instrument	Procedure	Frequency
Deionized/Distilled Water	Check conductivity Check deionizer light Monitor for VOA's System cleaning Replace cartridge & large mixed bed resins	Daily Daily Daily As required As required
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semi-annually
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required
BOD Incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly
Centrifuge	Check brushes and bearings	Every 6 months or as needed
Water baths	Temperature monitoring Water replaced	Daily Monthly or as needed

5.4.3 Equipment Verification and Calibration

All equipment is calibrated prior to use (Initial Calibration) to establish its ability to meet the QC guidelines contained in the test method for which the instrumentation is to be used. All sample measurements are made within the calibrated range of the instrument and in compliance with method requirements. The calibration data, which includes instrument conditions and standard concentrations, is documented in pre-formatted instrument runlogs or within LabNet itself. The preparation of all reference materials used for calibration is documented via LabNet.

Once an instrument is calibrated, ongoing instrument calibration is demonstrated (Continuing Calibration) at the appropriate frequency as defined in the test method. Refer to the STL Corporate Policy *Selection of Calibration Points* (P-T-001), for guidance on using calibration data. Any instrument that is deemed to be malfunctioning is clearly marked and taken out of service. When the instrument is brought back into control, acceptable performance is documented.

5.4.3.1 Instrument Calibration

Specific instrument calibration procedures for various instruments are summarized further in this section, and detailed in the respective analytical methods. Typically, more than one analytical method is available for an analysis. These various methods and other program requirements (e.g., U.S. EPA CLP, AFCEE, NFESC, USACE, QAPPs, contracts, etc..) may specify different calibration requirements. Therefore, calibration details as specified in the respective laboratory SOPs, Technical Profiles, QAPP, program requirements, and contracts supersede the general instrument calibration procedures are described further in Table 10. Complete details are provided in each method SOP.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
Metals (ICAP)	Initial Calibration	Following a period of time sufficient to warm up the instrument, the ICP is calibrated prior to each analytical run or minimally every 24 hours. Calibration standards are prepared from reliable reference materials and contain all metals for which analyses are being conducted. Working calibration standards are prepared fresh daily. Quarterly, multi-concentration calibration is performed to document linearity. On a day-to-day basis, 4 calibration standards (blank, high standard, 50% standard, and 20% standard) are analyzed. Prior to an analytical run, the instrument is calibrated using three standards. An Initial Calibration Verification (ICV) standard is analyzed immediately after standardization, followed by an Initial Calibration Blank (ICB). The ICV is from a source other than that used for initial calibration and the ICB must be free of target analytes at and above the value to be reported or appropriate corrective action must be taken. ICP Interference Check Samples (ICSA/ICSAB) are analyzed at the frequency described in each method SOP.
	Continuing Calibration	The initial calibration is verified during the analysis sequence by analysis of a Continuing Calibration Verification (CCV) standard and a Continuing Calibration Blank (CCB). The response of the CCV must be within the SOP-specified criteria (e.g., $\pm$ 10% recovery of the true value). The CCB must be free of target analytes at or above the value to be reported or appropriate corrective action must be taken. If any ICVs/CCVs or blanks exceed their acceptance criteria, appropriate corrective action must be taken.
Atomic Absorption (GFAA/ CVAA)	Initial Calibration	Initial calibration will include analysis of a calibration blank and a minimum of four (4) calibration standards covering the anticipated range of measurement. Duplicate injections are made for each concentration. Response readings, e.g., absorbance, are recorded and the resultant standard calibration curve calculated. If the SOP or program-specified criteria are not met, appropriate corrective action must be taken. An ICV standard will be analyzed immediately after standardization. The ICV must be within SOP-specified criteria (e.g., $\pm$5% of the true value for drinking water, and $\pm$10% in most other cases), or the initial calibration must be repeated. The ICV must be from a source other than that used for initial calibration. An ICB will be analyzed after the ICV. The ICB must be free of target analytes at and above a concentration in which sample results are reported, or corrective action must be taken.
	Continuing Calibration	The initial calibration is verified during the analysis sequence by evaluation of a CCV standard and a CCB, as described above. The CCV value must be within SOP-specified criteria (e.g., $\pm$10% recovery of the true value except for mercury within $\pm$20 % of the true value). The CCB must be free of target analytes at and above the concentration reported in samples. If any ICVs/CCVs or blanks exceed their acceptance criteria, corrective action must be taken.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
Inorganic Colorimetric Methods	Initial Calibration	A full initial standard calibration curve will be prepared for all colorimetric analyses on a daily basis. Working standards to define this curve will include a minimum of five (5) concentrations which cover the anticipated range of measurement, plus a calibration blank. At least one of the calibration standards will be at a concentration which will enable verification of instrument response near the reporting limit as defined in Section 8.6 or a level suitable for meeting specific program requirements. The requirement for an acceptable initial calibration is described in the analytical SOP. If the criteria are not met, appropriate corrective action must be taken. Calibration data, e.g., correlation coefficient, is entered into the laboratory notebook, or associated instrument printouts, and retained with the sample data. In lieu of a full initial curve, a daily calibration verification may be analyzed. This daily calibration will at a minimum consist of a blank and a mid-range standard. Results must be within SOP-specified criteria. If not, reanalysis of the standards may be done once to verify the readings; otherwise, a new curve will be developed. For procedures that require pretreatment steps, a minimum of one standard shall be prepared with the pretreatment. If the pre-treated standard is within SOP-specified criteria, the curve will be used. If the pre-treated sample is not within the criteria, the reason will be determined. If it is determined that the difference between the curves is inherent in the procedure, the curve will be based on the standards prepared and carried through the pretreatment. An ICV will be analyzed immediately after the standardization, followed by an ICB. The ICV must be from a source other than that used for initial calibration. The ICV must be within SOP-specified criteria and the ICB must be free of target analytes or appropriate corrective action must be taken.
	Continuing Calibration	The initial calibration is verified during the analysis sequence by analysis of a CCB and a CCV. If any ICVs/CCVs or blanks exceed their acceptance criteria, analysis is terminated, and the instrument is recalibrated. All samples since the last valid calibration verification are reanalyzed.
Ion Chromato-graphy	Initial Calibration	The ion chromatograph will be calibrated prior to each day of use. Calibration standards will be prepared from appropriate reference materials and will include a blank and a minimum of three concentrations to cover the anticipated range of measurements. At least one of the calibration standards will be at a concentration which will enable verification of instrument response near the reporting limit. If SOP-specified calibration criteria cannot be achieved, appropriate corrective action must be taken. Calibration data, e.g., correlation coefficient, will be archived with sample raw data.
	Continuing Calibration	A continuing calibration standard and blank will be analyzed at a frequency of 10% and at the end of the analysis shift. The response calculated as a percent recovery of the standard must meet SOP or program-specific criteria. The response of the blank must be less than the concentration to be reported for samples analyzed.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
GC/MS		All GC/MS instrumentation is calibrated to set specifications prior to sample analysis. These specifications vary depending on the requirements of the analytical program and the designated analytical method.
	Tuning and Mass Calibration	Mass spectrometers are calibrated with perfluorotributylamine (FC-43) or perfluorophenanthrene (FC- 5311) as required to ensure correct mass assignment. In addition, at the beginning of the daily work shift, the GC/MS system must be tuned with decafluorotriphenylphosphine (DFTPP) for semivolatiles analysis and 4-bromofluorobenzene (BFB) for volatiles analysis, and calibrated to target compounds. The majority of the laboratory work utilizes U.S. EPA-CLP or SW-846 protocols, which define the work shift as a 12-hour period initiated by the injection of DFTPP, BFB, or the dioxin/furan window mix. For drinking water programs (500 series methods), a 12-hour work shift is specified in the method for calibration frequency. For wastewater programs (600 series methods), the tune expires when the day's analytical sequence is complete; however, no time limit is given for the length of the daily GC/MS work shift. Ion abundances will be within the windows dictated by the specific program requirements.
	Initial Calibration	After an instrument has been tuned, initial calibration curves (minimum of 3-5 points) are generated for the compounds of interest. The low level standard must be at a concentration which will enable verification of instrument response near the reporting limit or at a concentration acceptable to meet program requirements. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must meet SOP or program-specified criteria prior to initiation of sample analysis. Any sample extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards. Instrument response to these target compounds are evaluated against SOP-specified criteria. Linearity is verified by evaluating the response factors (RF) for the initial calibration standards against SOP-specified criteria. Once an acceptable calibration is obtained, samples may be analyzed up until the expiration of the tune. At that time, the instrument must be re-tuned prior to further analysis. After acceptable tuning, a continuing calibration standard may be analyzed in lieu of a full multi-point calibration if the SOP-specified criteria are met. The majority of compounds analyzed for GC/MS comprise EPA's Target Compound List (TCL) or Priority Pollutant List (PPL). For add-on compounds not on the current TCL or PPL, initial calibration may be performed using a single point calibration of the additional compound(s), unless prior arrangements are made for a full three-to-five point calibration. Calibration data, to include linearity verification, will be maintained in the laboratory's records of instrument calibrations.
	Continuing Calibration	During each operating shift, a single calibration standard may be analyzed to verify that the instrument responses are still within the initial calibration determinations, as defined in the specific SOPs. If criteria cannot be met, appropriate corrective action must be taken.

Table 10. Minimum Instrument Calibration Procedures

Technique	Activity	Minimum Requirements
GC and HPLC		Gas chromatographs and high performance liquid chromatographs will be calibrated prior to use as described in analytical SOP or program requirements. Calibration standard mixtures will be prepared from appropriate reference materials and will contain analytes appropriate for the method of analysis or program requirements.
	Initial Calibration	Initial calibration will include a minimum of 3 to 5 calibration standards covering the anticipated range of measurement. The low level standard must be at a concentration which will enable verification of instrument response near the reporting limit or at a concentration acceptable to meet program requirements. The other standards must extend through the linear working range of the detector. The parameters requiring quantitation must meet SOP or program-specified criteria prior to initiation of sample analysis. Any sample extracts containing parameters of interest which exceed the concentration of the high level standard, must be diluted to bring the parameters within the range of the standards.
	Continuing Calibration	The response of the instrument will be verified for each analysis sequence by evaluation of a daily calibration verification standard at a mid-range concentration. In order to demonstrate that the initial calibration curve is still valid, the calibration check standard must be within SOP or program-specified acceptance criteria for the compounds of interest or the instrument must be recalibrated. For multi-analyte methods, this check standard may contain a representative number of target analytes rather than the full list of target compounds. Optionally, initial calibration (e.g., the full range of concentration levels) can be performed at the beginning of the analysis sequence. Within the analysis sequence, instrument drift will be monitored by analysis of a mid-range calibration standard every ten samples or 12 hour sequence (depending on the method protocol), including external QC. If the SOP or program-specified calibration criteria are not met for the compounds of interest, appropriate corrective action must be taken.

5.5 Measurement Traceability

5.5.1 General

Traceability of measurements is assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard is subject to ongoing certifications of accuracy.

At a minimum, these include procedures for checking specifications for balances, thermometers, temperature, De-ionized (DI) and Reverse Osmosis (RO) water systems, automatic/eppendorf pipettes and other volumetric measuring devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards [with the exception of class A glassware (including glass microliter syringes that have a certificate of accuracy)].

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balances are calibrated on each day of use (*Balance Calibration, Care and Use*; UQA-003). All thermometers and temperature monitoring devices are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use (*Thermometer Calibrations*; UQA-034).

Laboratory DI and RO water systems have documented preventative maintenance schedules and the conductivity of the water is recorded on each day of use (*Water Quality*; UQA-035).

5.5.2 Reference Standards

The receipt of all reference standards is documented in LabNet. Standards are obtained from commercial vendors and sources may vary depending upon the availability of mixes and solutions from vendors. Each production unit is responsible to ensure, when available, that all standards are traceable to EPA, NIST, A2LA, SARMs and are accompanied by a Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis.

The receipt of each dry chemical, purchased stock solution or reference material to be used as a standard is assigned a unique ID number. The chemical name, manufacturer, lot number, date received, expiration date, date opened and initials of the analyst who opened the chemical are documented. The expiration dates for ampulated solutions shall not exceed the manufacturer's expiration date. Expiration dates for laboratory-prepared stock and diluted standards shall be no later than the expiration date of the stock solution or material or the date calculated from the holding time allowed by the applicable analytical method, whichever comes first. Expiration dates for pure chemicals shall be established by the laboratory and be based on chemical stability, possibility of contamination, and environmental and storage conditions. Expired standard materials shall be either revalidated prior to use or discarded. Revalidation may be performed through assignment of a true value and error window statistically derived from replicate analyses of the material as compared to an unexpired standard. The laboratory labels all standard and QC materials with expiration dates.

The preparation of all daughter solutions, whether a single or multiple-component stock, intermediate, or working standard solution, is documented in a standard solution preparation logbook, in a designated section of the analytical logbook or in the LabNet systems reagent program. This documentation references the Standard ID of the respective parent solution(s) used in its preparation, providing a solid trail back to the solution or chemical received from the vendor. These records include the standard name, final volume, matrix, final concentration, analyst initials, prep date and expiration date. A daughter solution should not have an expiration date which post-dates any of the parent solutions used in its preparation.

References standards are labeled with a unique Standard Identification Number, date received, and the expiration date. All documentation received with the reference standard or documentation of standard purity is retained as a QC record and references the Standard Identification Number. All efforts are made to purchase standards that are $\geq$ 97.0% purity. If this is not possible, the purity is used in performing standards calculations.

The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a different lot is acceptable for use as a second source. The appropriate QC criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an ICV or LCS is used as the second source confirmation.

Storage conditions, such as shelf life, ambient or chilled, controlled or restricted access, wet or desiccated, etc.., are in conformance with the specifications set in the associated method, the program requirements, or the manufacturer's recommendation, as appropriate.

5.5.3 Reagents

Reagents are, in general, required to be analytical reagent grade unless otherwise specified in method SOPs. Reagents must be, at a minimum, the purity required in the test method. The date of reagent receipt, date the reagent was opened, and the date of reagent preparation (where applicable) are documented in LabNet for reagent traceability.

5.6 Sampling

Sample representativeness and integrity are the foundations upon which meaningful analytical results rely. Where documented and approved SAPs and/or QAPPs are in place, they must be made available to the laboratory before sample receipt, and approved by laboratory management before sample receipt.

5.7 Sample Handling, Transport, and Storage

5.7.1 General

COC can be established either when bottles are sent to the field, or at the time of sampling. STL can provide all of the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory. Complete details for sample container preparation are contained within UCM-001. A summary of sample receipt is as follows with complete details available within the *Sample Receipt and Handling* SOP (USR-001).

Samples are received at the laboratory by the designated sample custodians and a unique LabNet job (batch) number and unique bottle ID is assigned. The following information is recorded for each sample shipment:

- Client/Project Name.
- Date and Time of Laboratory Receipt.
- Laboratory Job Number
- Signature or initials of the personnel receiving the cooler and making the entries.

Upon inspection of the cooler and custody seals, the sample custodian opens and inspects the contents of the cooler, and records the cooler temperature. If the cooler arrival temperature exceeds the required or method specified temperature range by $\pm 2^{\circ}C$ (for samples with a temperature requirement of $4^{\circ}C$, a cooler temperature of just above the water freezing temperature to $6^{\circ}C$ is acceptable); sample receipt is considered "compromised" and the procedure described in Section 4.7.1 is followed. All documents are immediately inspected to assure agreement between the test samples received and the COC.

Any non-conformance, irregularity, or compromised sample receipt as described in Section 4.7.1 is documented in an SDR and Sample Receipt Checklist and brought to the immediate attention of the Project Manager for resolution with the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the permanent project record.

Samples that are being tested at another STL facility or by an external subcontractor are repackaged, iced, and sent out under COC.

Following sample labeling as described in Section 5.7.2, the sample is placed in storage. Refrigerated storage coolers are maintained at $4 \pm 2^{\circ}C$. The temperature is continually being monitored by an electronic monitoring software program. *(Thermometer Calibrations and Electronic Monitoring: UQA-034)* All samples are stored according to the requirements outlined in the test method, and in a manner such that they are not subject to cross contamination or contamination from their environment.

Access to the laboratory is restricted to laboratory personnel or escorted guests as described in Section 5.2. Therefore, once sample possession is relinquished to the laboratory, the sample is in a designated secure area (e.g., the laboratory facility) accessible only to authorized personnel. Locked storage coolers are available for protocol (e.g., AFCEE and CLP) that require internal COC procedures.

5.7.2 Sample Identification and Traceability

The sample custodian organizes the sample containers, COCs, and all pertinent information associated with the samples. The sample identity is verified against all associated sample information. Any inconsistencies are documented via an SDR and forwarded to the Project Manager for resolution with the client prior to identifying the sample(s) into LabNet.

Each sample container is assigned a unique Sample Identification Number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label.

All unused portions of samples, including empty sample containers, are returned to the secure sample control area.

5.7.3 Sub-Sampling

Taking a representative sub-sample from a container containing a soil or solid matrix is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation.

After thoroughly mixing the sample within the sample container or transfer to a wip bag (or other suitable plastic bag), a sub-sample from various quadrants and depths of the sample are taken to acquire the required sample weight. Any non-homogenous looking material is avoided and noted as such within the sample preparation record.

5.7.4 Sample Preparation

Sample preparation procedures vary for each matrix and analytical method are as referenced in the laboratory SOPs.

5.7.5 Sample Disposal

Samples are retained in STL storage facilities for 30 days after the project report is sent unless prior written arrangements have been made with the client. Samples may be held longer or returned to the client per written request. Unused portions of samples are disposed of in accordance with federal, state and local regulations. The laboratory removes or defaces sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). Complete details on the disposal of samples, digestates, and extracts is available within the *Laboratory Waste Disposal Procedures* SOP (UWM-001).

5.8 Assuring the Quality of Test Results

5.8.1 Proficiency Testing

The laboratory analyzes Proficiency Test (PT) samples as required for accreditation and as outlined in NELAC. The laboratory participates in the PT program semi-annually for each PT field of testing for which it is accredited, according to the NELAC PT field of testing published guidelines. This includes drinking water, wastewater and solid/soil matrices.

The laboratory also participate various client PT programs, when submitted.

PT samples are handled and tested in the same manner (procedural, equipment, staff) as environmental samples. Results of PT samples are distributed to the laboratory section managers for review and corrective action, if required. Any required corrective action response to deficiencies is submitted to the QA department for review and are filed with the PT study records. PT test sample data is archived using the requirements for project and raw data record retention. Refer to the SOP: *PT Sample Tracking/Analysis (UQA-018)* for further details.

5.8.1.1 Double Blind Performance Evaluation

The laboratory participates in an annual double blind performance evaluation study. An external vendor is contracted to submit double blind samples to the laboratory. Both the level of customer service and the accuracy of the test results are assessed objectively by the external contractor, who provides a detailed report to the Corporate Quality Director and to the laboratory. This is administered as a double blind program in order to assess all facets of the laboratory's operations.

5.8.2 Control Samples

Control samples (e.g., QC indicators) are analyzed with each batch of samples to monitor laboratory performance in terms of accuracy, precision, sensitivity, selectivity, and interferences. Control samples must be uniquely identified and correlated to unique batches. Control samples further evaluate data based upon (1) Method Performance, which entails both the preparation and measurement steps; and (2) Matrix Effects, which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch.

Control sample types and typical frequency of their application are outlined Sections 5.8.2.1 through 5.8.2.5 and Tables 11 through 15. Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method and regulatory program control samples are as listed in Sections 7 and 8 of each method SOP.

5.8.2.1 Method Performance Control Samples: Preparation Batch

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment.

Control samples are added to each prep batch to monitor method performance (Table 11) and are processed through the entire analytical procedure with investigative/field samples.

Field blanks, equipment blank and trip blanks, when received, are analyzed in the same manner as other field samples. However, a field blank should not be selected for matrix QC, as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB".

5.8.2.2 Method Performance Control Samples: Matrix

Matrix control samples include sample duplicates (MD), sample matrix spikes (MS), and sample surrogate spikes. These control samples help monitor for potential physical and chemical effects which may interfere with the precision and/or accuracy of the selected analytical method. Since interferences can enhance or mask the presence of target analytes, matrix control samples measure the degree of interference and are used to assist in the interpretation of the analytical results. The laboratory avoids performing matrix QC on known field blank samples, such as trip blanks and rinsates, since these samples are not indicative of the sample matrix.

Table 11. Preparation Batch Control Samples

Control Type	Details	
Method Blank (MB)	Use	Monitors for potential contamination introduced during the sample preparation and analytical processes.
	Typical Frequency [1]	1 per batch of $\leq$ 20 samples per matrix type per sample extraction or preparation method.
	Description	Organics: Laboratory pure water for water samples or a purified solid matrix for soil or solid samples (when available or when requested); solid matrices commonly include sodium sulfate, vendor or agency supplied soil or solid, or purchased sand; these solids may require purification at the laboratory prior to use. Inorganics: Laboratory pure water for both water and soil or sediment samples. Volume/weights are selected to approximately equal the typical sample volume/weight used in sample preparation; and final results in a soil/solid batch may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison to actual field samples.
Laboratory Control Sample (LCS)	Use	Measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects.
	Typical Frequency [1]	1 per batch of $\leq$ 20 samples per matrix type per sample extraction or preparation method. For multi-analyte methods, the LCS may consist of surrogates in the blank matrix, and or a representative selection of target analytes/internal standards.
	Description	Prepared from a reference source of known concentration and processed through the preparation and analysis steps concurrently with the field samples. Aqueous LCS's may be processed for solid matrices unless a solid LCS is requested; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.
Known QC Sample	Use	Comply with regulatory requirements; check the accuracy of an analytical procedure; troubleshoot method performance problems; verify an analyst in training's ability to accurately perform a method; to verify the return-to-control after method performance problems; and may also be used as an LCS.
	Typical Frequency [1]	As defined by the client or QAPP.
	Description	Obtained from outside suppliers or agencies; generally require preparation from concentrated materials by dilution into a standard matrix; contain known analytes or compounds; acceptance limits are provided by the vendor.

[1] Denotes an STL required frequency.

Table 12. Matrix Control Samples

Control Type	Details	
Matrix Duplicate (MD)	Use	Monitors the effect of site matrix on the precision of the method; and of the reproducibility of laboratory preparation and measurement techniques. **Note:** Precision may also be affected by the degree of homogeneity of the sample, particularly in the case of non-aqueous samples or aqueous samples with particulates. Sample homogeneity and matrix effect should be considered when field samples are used to assess reproducibility. **Note:** A field duplicate, when received, measures Representativeness of sampling and the effect of the site matrix upon precision.
	Typical Frequency [1]	1 per 20 samples per matrix or per SAP/QAPP [2].
	Description	Performed by analyzing two aliquots of the same field sample independently; analyzed for each associated sample matrix (e.g., when requested by the client or the analytical method).
Matrix Spike (MS)	Use	Measures the effect of site sample matrix on the accuracy of the method.
	Typical Frequency [1]	1 per 20 samples per matrix or per SAP/QAPP.
	Description	Aliquot of a field sample which is spiked with the analytes or compounds of interest; analyzed for each associated sample matrix (when requested by the client or analytical method). The determination of MS percent recovery (% R) requires an analysis of a fortified sample and a non-fortified sample under the same procedural conditions (e.g., sample volumes, dilutions, procedural conditions, etc..). The concentration determined in the non-fortified sample is subtracted from the fortified sample concentration before determining the %R. The degree of homogeneity of the sample, particularly in the case on non-aqueous samples or samples with particulates, may affect the ability to obtain representative recoveries.
Matrix Spike Duplicate (MSD)	Use	Measures effect of site sample matrix on precision of method.
	Typical Frequency [1]	1 per 20 samples per matrix, when requested by the client or the analytical method, or per SAP/QAPP [2].
	Description	Alternative to sample duplicate. Generally, inorganic protocols specify an MD/MS and organic protocols specify an MS/MSD.
Surrogate Spike	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Every QC and analytical sample.
	Description	Compounds similar to the target analytes in structure, composition and chromatography, but not typically found in the environment, are added to each QC and analytical sample, prior to preparation (e.g., extraction). If the surrogates in an analytical batch do not all conform to established control limits, the pattern of conformance in investigative and control samples is examined to determine the presence of matrix interference or the need for corrective action.
Internal Standards	Use	Monitor the qualitative aspect of organic and inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] Denotes an STL required frequency.
[2] Either an MSD or an MD is required per 20 samples per matrix or per SAP/QAPP.

5.8.2.3 Matrix QC Frequencies

The frequency of matrix QC indicators depends on regulatory program compliance, a project's data quality objectives, or a client's requirements. The following frequency will be applied to samples when the regulatory programs are known and it does not conflict with project or client requirements.

Table 13. EPA Program Requirements

Program	Description [1]
SDWA	MD performed at a 10% frequency or 1 per preparation batch of ≤10 samples, whichever is more frequent.
CWA	MS (GC methods) and MD is performed at a 10% frequency or 1 per preparation batch of ≤10 samples, whichever is more frequent. For GC/MS Methods, MS is performed at a 5% frequency or 1 per preparation batch of ≤20 samples, whichever is more frequent.
RCRA	MS/MSD or MS/MD is performed at a rate of 5% per client (independent of the preparation batch). For clients submitting less than 10 samples, the method matrix QC requirement may be satisfied by another clients sample within the same prep batch unless the paperwork indicates a client requirement for matrix QC. Matrix QC will only be reported to the client who owns the data.
U.S. EPA CLP	MS/MSD or MS/MD is performed at a rate of 5% or 1 set per Sample Delivery Group (SDG) per matrix, independent of the prep batch. For NFESC samples, samples are processed in simultaneous or continuous batches.

[1] MS, MSD and MD may not be applicable to some analytical protocols because of the nature of the sample or protocol.

5.8.2.4 Method Performance Control Samples: Instrument Measurement

Control samples are used to ensure that optimum instrument performance is achieved. These samples help ensure that the proper identification and quantitation of target compounds or analytes are achieved. The instrument control samples appropriate to each analytical technique are described in laboratory SOPs for each respective method. A brief description of these checks is included in Table 14.

Table 14. Instrument Performance Control Samples

Control Type		Description
Inorganics		
ICV	Use	Calibration standard of known concentration prepared from a source other than that used for the calibration standards.
	Sequence	Analyzed after the standard curve to confirm calibration.
ICB	Use	Blank water or solvent; confirms the calibration and assures that any potential contamination is less than the reporting limit.
	Sequence	Analyzed immediately after the ICV.
ICP Interference Check Samples (ICSA/ICSB)	Use	Verifies the absence of spectral interferences.
	Sequence	Analyzed consecutively at the beginning of each eight hour analytical sequence, after the ICV/ICB, and again at an eight hour frequency following a CCV/CCB. When CLP protocols are followed, the ICSA/B will be analyzed with the analytical sequence, before the final CCV/CCB.
Reporting Limit Verification Standard (CRA & CRI)	Use	Verifies linearity near the reporting limit for CLP metals analyses. (Note: CRI is at a level 2X the CRDL; CRA is near the CRDL).
	Sequence	Analyzed after the ICB. The CRI is also analyzed at the end of the eight hour analytical sequence, prior to analysis of the final CCV/CCB.
CCV	Use	Confirm that the instrument performance has not significantly changed during the analytical sequence; to verify stable calibration throughout the sequence; and/or to demonstrate that instrument response did not drift over a period of non-use. Made from a source other than that used for the standard curve.
	Sequence	Analyzed at 10% or every two hours, whichever is more frequent; also analyzed at the end of the analytical sequence.
CCB	Use	Water blank used to confirm that the baseline has not drifted and to monitor for contamination at the reporting limit.
	Sequence	Analyzed at a rate of 10% for inorganics and at a rate of 1 per 10 readings/injections or every two hours, whichever is more frequent, for CLP metals; also analyzed at the end of the analytical sequence.
ICP Metals Linear Range	Use	Verify linearity and document the upper limit of the calibration range for each element.
Analysis Standard (LRS)	Sequence	Performed quarterly with a blank and a minimum of five standard concentrations to cover the anticipated range of measurement; one of the calibration standards will be at or near the reporting limit. The calibration curve generated must have a correlation coefficient $\geq$ 0.995 in order to consider the responses linear over that range.
ICP Inter-Element Correction (IEC)	Use	Correction factors for spectral interference (particularly due to Al, Ca, Fe, and Mg).
	Sequence	Determined at least annually for all wavelengths used for each analyte reported by ICP; or any time the ICP is adjusted in any way that may affect the IECs.

Table 14. Instrument Performance Control Samples

Control Type		Description
		Organics
GC/MS Tuning & Performance	Use	Ensures correct mass assignment and is monitored through response to target compounds during initial and continuing calibration, with minimum response criteria for specified system performance check compounds (SPCCs), and linearity is verified by evaluating the response factors (RF) for calibration check compounds (CCCs).
	Sequence	Tuned at the beginning of the daily work shift. Throughout the analysis, blanks, internal standard areas, surrogates, chromatographic baseline, resolution of peaks, and overall quality of the chromatography are used collectively to monitor instrument performance.
GC & HPLC Instrument Performance	Use	Monitored through retention time shift evaluation, linearity checks, and degradation checks of selected target compounds (e.g., for Endrin or DDT as appropriate).
	Sequence	Continuing calibration verification (e.g., blanks, shifts in chromatographic baseline or retention times, resolution of peaks, and overall quality of the chromatography) throughout the analytical sequence is accomplished through analysis of calibration check standards.

5.8.2.5 Method Performance Control Samples: Analysis Batch

Matrix specific control samples are used to assess the precision and accuracy of the method as applied to the specific sample matrix. These indicators provide information on sample matrix effects that is independent of the efficiency of the preparatory technique. The method performance control samples appropriate to each analytical technique are identified in the respective method. A brief description of these checks is included in Table 15.

These control samples are performed to provide a tool for evaluating how well the method performed for the respective matrix. These values are used by the client to assess the validity of a reported result within the context of the project's data quality objectives. For matrix specific QC results falling outside laboratory control limits which are attributed to matrix affects, no systematic corrective action is taken.

Table 15. Analysis Batch Performance Control Samples

Control Sample Type	Description	
ICP Serial Dilution	Use	5X Dilution of a field sample (performed at the instrument) to check for possible physical and/or chemical interferences.
	Sequence	5% of field samples or 1 per ≤20 samples per batch.
GFAA Analytical Bench Spike	Use	Required by the method; prepared at the instrument by fortifying the digestate with a known quantity of the analyte of interest.
	Sequence	Performed on each sample immediately following the unspiked original analysis.
Method of Standard Addition (MSA)	Use	When specified by the analytical protocol or by client request.
	Sequence	When specified by the analytical protocol or by client request.

5.8.3 Statistical Control Limits and Charts

Statistical control limits and control charts are used to establish method performance of a given analysis and to monitor trends of QC results graphically over time. Once a data base of the laboratory results for a method/matrix/QC analyte combination is established, the acceptability of a given analysis of that QC parameter (and of the analytical batch to which it belongs) can be evaluated in light of the laboratory's normal performance. This is intended to help identify problems before they might affect data. Often, patterns of response that are not at all evident in sets of numbers are very distinct when the same values are viewed as a chronological graph.

Establishment of Limits
The purpose of using statistical control limits is to define, for each analyte in a given method/matrix/QC type combination, a range of expected values. This range encompasses the random variation that occurs normally in the laboratory and allows one to evaluate control samples in that context, rather than according to an arbitrary or external set of values. Limits for accuracy and precision are defined below:

Accuracy
As recoveries of a QC analyte in a given matrix are tabulated over time, a mean value for recovery is established, as is the standard deviation (s) of those recoveries. If the analysis is in statistical control (e.g., if the set of QC recoveries over time show random variation about the mean) approximately 99.7% of all recoveries for that QC will fall within three standard deviations (3s) of the mean. Thus, assuming that the mean itself is an acceptable level of recovery, the values corresponding to 3s above and 3s below the mean are defined as the Control Limits. Any single recovery outside these values is assumed to have resulted from some circumstance other than normal variation and shall be investigated.

Roughly 95% of points should fall within 2s of the mean. The values +2s and -2s are the Warning Limits. Any normal result has approximately a 1/20 chance of being between 2s and 3s from the mean, so a result in this region doesn't necessarily warrant corrective action, but attention should be paid to such points.

Precision
Precision is used to indicate matrix variability so that appropriate decisions can be made by the client when repeated analyses vary significantly. The coefficient of variation, expressed as a percentage (e.g., the %RSD) for the data set used to calculate accuracy control limits defines the control limit for precision. Duplicate analyses of the QC samples, such as duplicates or MS/MSD, should have an RPD less than or equal to this established precision control limit to be considered free of matrix interferences.

The laboratory calculates statistical control limits on an annual basis. Such limits are available on a project or QAPP-specific basis.

5.8.4 Calibration

Calibration protocols are method-specific, are briefly described in Table 10 and are defined in the Sections 6 & 7 of the method SOPs.

5.8.5 Glassware Cleaning

All glassware is thoroughly cleaned prior to use to ensure that sample integrity is not affected from artifacts caused by contaminated glassware.

A summary of general cleaning procedures follows with details provided in the *Laboratory Glassware Cleaning* SOP (UQA-009):

General laboratory glassware is cleaned with a low- or non-phosphate detergent, followed by thorough rinsing with tap water and deionized water.

Volumetric flasks and pipettes used for inorganics (method dependent), test tubes and caps used for micro-COD procedures, phosphate glassware, and metals-related glassware include an acid-washing step.

BOD glassware cleaning includes a nitric or sulfuric acid and/or a NOCHROMIX-washing step.

Organic glassware includes a solvent-wash.

Non-volumetric organic glassware may optionally be kiln dried at 400°C.

5.8.6 Permitting Departures from Documented Procedure

Where a departure from a documented SOP, test method, or policy is determined to be necessary, or unavoidable, the departure is documented in a CAR or SDR and reported in the case narrative. In most cases, these departures can be made with the approval of the section manager, project manager and the client. Issues of serious concern, as determined by the Section Manager or Project Manager, will be brought to the attention of the Laboratory Director and/or QA Manager. In some instances, it is appropriate to inform the client before permitting a departure. The Project Manager will make the determination as to the degree of notification required by the client.

On rare occasions, special analytical techniques will be requested for research, project specific requirements, or client needs. In these instances, SOPs may not be available, however, the analyst will thoroughly record the analytical steps and observations within a bound preformatted logbook.

5.8.7 Development of QC Criteria, Non-Specified in Method/Regulation

Where a method or regulation does not specify acceptance and/or rejection criteria, the laboratory must examine the data user's needs and the demonstrated sensitivity, accuracy and precision of the available test methods in determining appropriate QC criteria.

Data users often need the laboratory's best possible sensitivity, accuracy, and precision using a routinely offered test method, or are unsure of their objectives for the data. For routine test methods that are offered as part of STL's standard services, the laboratory bases the QC criteria on statistical information such as determination of sensitivity, historical accuracy and precision data, and method verification data. The method SOP includes QC criteria for ongoing demonstration that the established criteria are met (e.g., acceptable LCS accuracy ranges, precision requirements, method blank requirements, initial and continuing calibration criteria, etc..).

In some cases, a routine test method may be far more stringent than a specific data user's needs for a project. The laboratory may either use the routinely offered test method, or may opt to develop an alternate test method based on the data user's objectives for sensitivity, accuracy, and precision. In this case, it can be appropriate to base the QC criteria on the data user's objectives, and demonstrate through method verification and ongoing QC samples that these objectives are met.

For example, a client may require that the laboratory to test for a single analyte with specific DQOs for sensitivity, accuracy, and precision as follows: Reporting Limit of 10 ppm, Accuracy $\pm$25%, and RSD of <30%. The laboratory may opt to develop a method that meets these criteria and document through the Method Blank results, MDL study, and LCS results that the method satisfies those objectives. In this case, both the method and the embedded QC criteria have been based on the client's DQOs.

In some cases, the data user needs more stringent sensitivity, accuracy, and/or precision than the laboratory can provide using a routine test method. In this case, it is appropriate that the laboratory provide documentation of the sensitivity, accuracy, and precision obtainable to the data user and let the data user determine whether to use the best available method offered by the laboratory, or determine whether method development or further research is required.

5.9 Project Reports

The SOP for data package assembly and reporting formats is defined in the *Data Management, Process Operation SOP* (UDM-001) and a summary of this procedure follows.

Analytical reports comprise final results (uncorrected for blanks and recoveries unless specified), methods of analysis, levels of reporting, surrogate recovery data, and method blank data. In addition, special analytical problems will be noted in the case narratives. The number of significant figures reported are consistent with the limits of uncertainty inherent in the analytical method. Consequently, most analytical results will be reported to no more than two (2) or three (3) significant figures. Data are normally reported in units commonly used for the analyses performed.

Concentrations in liquids are expressed in terms of weight per unit volume (e.g., milligrams per liter, mg/L). Concentrations in solid or semi-solid matrices are expressed in terms of weight per unit weight of sample (e.g., micrograms per kilograms, ug/kg). Reporting limits take into account all appropriate concentration, dilution, and/or extraction factors, unless otherwise specified by program requirements (e.g., IRPMS reports).

A client report is generated with various steps of approval prior to printing of the final version. If any analytical anomalies were encountered during the analyses, e.g., an out-of-control matrix duplicate, it is documented in a case narrative. The case narrative is prepared by the respective operating unit and submitted to the data management section to insert in the final report.

The final report forms are printed, data packages are organized, a glossary of flags and acronyms is added, and reports are paginated.

5.9.1 General

The criteria described in Section 5.9.2 apply to all Project Reports that are generated under NELAC requirements. The criteria described in Section 5.9.3 and 5.9.4 apply to all Project Reports.

5.9.2 Project Report Content

- Title
- Laboratory name, address, telephone number, contact person
- Unique Laboratory Project Number
- Name and Address of Client
- Client Project Name (if applicable)
- Laboratory Sample Identification
- Client Sample Identification
- Matrix and/or Description of Sample
- Dates: Sample Receipt, Collection, Preparation and/or Analysis Date
- Definition of Data Qualifiers
- Reporting Units
- Test Methods
- Report Paginated

The following are required where applicable to the specific test method or matrix:

- Solid Samples: Indicate Dry or Wet Weight
- Whole Effluent Toxicity: Statistical package used
- If holding time $\leq$ 48 hours, Sample Collection, Preparation and/or Analysis Time
- Indication by flagging where results are reported below the quantitation limit.

5.9.3 Project Narrative

A Project Narrative and/or Cover Letter is included with each project report and, at a minimum, includes an explanation of any and all of the following occurrences:

- Non-conformances
- "Compromised" sample receipt (see Section 4.7.1)
- Method Deviations
- QC criteria failures

Project Release

The Project Manager or his designee authorizes the release of the project report with a signature.

Where amendments to project reports are required after issue, these are documented in the form of an RDR (refer to Section 4.8) and can be in the form of a separate document and/or electronic data deliverable resubmittal. The revised report is clearly identified as revised with the date of revision and the initials of the person making the revision. Specific pages of a project report may be revised using the above procedure with an accompanying cover letter indicating the page numbers of the project revised. The original version of the project report will be kept intact and the revisions and cover letter included in the project files.

5.9.4 Subcontractor Test Results

Subcontracted data is clearly identified as such, and the name, address, and telephone number for the laboratory performing the test is included in the project report. Subcontracted results from laboratories external to STL are not reported on STL report forms or STL letterhead. Test results from more than one STL facility are clearly identified with the name of the STL facility that performed the testing, address, and telephone number for that facility. Data from subcontractors' reports may be added to an STL electronic deliverable.

Data subcontracted within STL may be reported on the originating laboratory's report forms provided the following mandatory requirements are met:

- The name, address, and telephone number of the facility are provided.
- Analytical results produced by the STL intra-company subcontractor are clearly identified as being produced by the subcontractor facility.
- The intra-company subcontractor's original report, including the chain of custody is retained by the originating laboratory.
- Proof of certification is retained by the originating laboratory.
- All information as outlined in Section 5.9.2 is included in the final report where the report is required to be compliant with NELAC, for both the originating and subcontracting laboratory.

5.9.5 Electronic Data Deliverables

Electronic Data Deliverables (EDD) are routinely offered as part of STL's services. STL offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), New Agency Standard (NAS), Format A, Excel, Dbase, GISKEY, and Text Files.

EDD specifications are submitted to the EDD development staff by the PM for review and undergo the contract review process in Section 4.4.1. Once the laboratory has committed to providing diskettes in a specific format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained as a QC record.

EDDs are subject to a secondary review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory demonstrates that it can routinely generate that EDD without errors. Any revisions to the EDD format are reviewed until it is demonstrated that it can routinely be generated without errors. (*EDD SOP*: UIS-001)

5.9.6 Project Report Format

STL offers a wide range of project reporting formats, including EDDs, short report formats, and complete data deliverable packages modeled on the Contract Laboratory Protocol (CLP) guidelines. More information on the range of project reports available in the Data Management SOP (UDM-001). Regardless of the level of reporting, all projects undergo the levels of review as described in Section 5.3.6.

Appendix. List of Cited SOPs and Work Instructions

Cited Sec. No(s)	Description	Document No.
1.6; 5.7.1	Container Management: Process Operation	UCM-001
1.6; 4.4.2	Project Management: Project Planning Process	UPM-003
4.1	Signature Authority	UQA-030
4.1.1	Work Instruction: Equipment & Instrumentation Listing	CHI-22-09-103
4.1.2.9	Internet Use Policy Electronic Mail Use Computer System Account and Naming Policy Computer System Password Policy Software Licensing Policy Virus Protection Policy	P-I-001 P-I-002 P-I-003 P-I-004 P-I-005 P-I-006
4.3.1	Document Control	UQA-006
4.3.1.1; 5.3.2	Approved SOP Listing	CHI-22-09-SOP
4.3.2; 4.12.3	Data Management: Record Retention & Purging	UDM-002
4.4.2	Project Kick-Off Meetings	UPM-002
4.4.2	Production Meetings	UPM-004
4.4.3.6	IDL's for CLP Metals and Cyanide	UQA-010
4.4.3.6; 5.3.5	Method Detection Limits (MDLs)	UQA-017
4.5	Work Sharing Process - Policy	S-C-001
4.6	Procurement Quality Assurance Process	UQA-020
4.6.1	Testing Solvents and Acids	S-T-001
4.7.2	Client Confidentiality	UQA-004
4.8; 4.11	Sample Discrepancy Reports (SDRs) / Resubmitted Data Reports (RDRs) / Corrective Action Reports (CARs)	UQA-029
4.8; 4.11	Quality Systems Management Review	UQA-002
4.11	Preventive Action Measures	UQA-019
4.12.2	Work Instruction: Records Management Form	CHI-22-05-032
4.13	Internal Audits	UQA-013
5.1.2	Training Program: Mechanisms and Documentation Processes Defined by Operational Assessment	UQA-014
5.1.2	STL Chicago Demonstration of Capability Certification Statement	CHI-22-09-271
5.1.2	STL Chicago Yearly Method Capability Review Work Instruction: WC	CHI-22-09-279
5.1.3	Ethics Policy	P-L-006
5.3.1	Work Instruction: Methods Capabilities	CHI-22-09-255
5.3.2	SOP Change Protocol	UQA-032
5.3.5	MDL Policy	S-Q-003
5.3.6.1	Acceptable Manual Integration Practices	S-Q-004
5.3.6.2	Data Review Checklists GC Extractables / HPLC GC Volatiles GC/MS: Volatiles and Semivolatiles Metals Wet Chemistry	 CHI-22-17-034 CHI-22-19-003 CHI-22-20-038 CHI-22-14-004; 5; 6 CHI-22-12-014
5.4.1	Work Instruction: Equipment Tracking Form	CHI-22-09-068
5.4.2	Instrument and Equipment Out-of-Service Tagging.	UQA-012

SOP No.	Revision No.	Date	Page
USP-3000	13	02/18/05	1 of 15

TITLE: SAMPLE PREPARATION
Metals Digestion by SW-846 3000 Series

Updated by:	Signature:	Date:
Carla Bonner Analyst, Metals Department	Carla Bonner	2-15-05

Approved by:	Signature:	Date:
Jodi L. Gromala Supervisor, Metals Dept.	Jodi L. Gromala	2-15-05
David W. Mazur Env. Health & Safety Coor.	D. W. Mazur	2/16/05
Terese A. Preston Quality Manager	Terese A. Preston	2/16/05

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Full Signature Approvals Are Kept on File with STLs QA Standard Practice Records

1.0 SCOPE / APPLICATION

This Standard Operating Procedure (SOP) outlines the guidelines for the preparation of wastewaters, extracts, wastes and soil samples for metals analysis by Trace Inductively Couples Argon Plasma (ICP) and Graphite Furnace AA (GFAA). This SOP was written using the following methods of SW-846, Third Edition:

Method	Description
3005A	Surface and ground waters for analysis by Trace ICP.
3010A	Waters and extracts for analysis by Trace ICP.
3020A	Waters and extracts for analysis by GFAA (excluding As and Se).
3020A Modified	Waters and extracts for analysis by GFAA (including As and Se w/ H_2O_2).
3050B	Soil and waste samples for analysis by Trace ICP or GFAA.
7060A	Waters for As by GFAA.
7740	Waters for Se by GFAA.

On occasion, clients request slight modifications to this SOP. These modifications are addressed on a case-by-case basis with the range of accuracy (i.e., MDLs, linearity check or PT sample) verified prior to implementation. Any modifications would be written into a Quality Assurance Plan (QAP), authorized via laboratory signature approval, and mentioned in the data package's case narrative.

1.1 Method Sensitivity

1.1.1 Method Detection Limits

Not Applicable. Refer to the analytical SOPs.

1.1.2 Reporting Limits

Not Applicable. Refer to the analytical SOPs.

1.1.3 Definitions

Refer to Section 3.0 of the Laboratory's Quality Manual (LQM).

1.2 Summary of Method

Water and soil samples are digested with nitric acid, hydrochloric acid and/or hydrogen peroxide to produce digestates that are in the correct acid media for analysis by the Trace ICP or GFAA.

2.0 INTERFERENCES

Matrix interferences are usually not present for the digestion process. Analytical matrix interferences may be apparent during the instrumental analysis of the digestates. The type of interferences for the instruments are discussed in the appropriate SOPs.

3.0 SAFETY

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

3.1 Specific Safety Concerns or Requirements

- Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.
- Acid vapor can be dangerous. Work in a well ventilated area (i.e., fume hood).
- Hydrogen peroxide (H_2O_2) is a strong oxidizer and is corrosive. The digestion must be cooled sufficiently before the addition of H_2O_2 to avoid a reaction and possible violent effervescence, or boiling over of the digestion. A splash/splatter hazard is possible and a face shield should be worn

3.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE:** This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table. A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Hydrochloric Acid	Corrosive Poison	5 ppm-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Hydrogen Peroxide	Oxidizer Corrosive	1 ppm-TWA	Vapors are corrosive and irritating to the respiratory tract. Vapors are very corrosive and irritating to the eyes and skin.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
1 – Always add acid to water to prevent violent reactions. 2 – Exposure limit refers to the OSHA regulatory exposure limit.			

4.0 EQUIPMENT AND SUPPLIES

- Top loading balance
- Hot plate (w/ thermometer)
- Hot Block w/ digestion vessels (w/ thermometer)
- 250 mL beakers
- 100 mL graduated cylinders
- Whatman No. 541 filter paper
- Funnels
- 100 & 50 mL Class A volumetric flasks
- Fume hood(s)
- Eppendorf Pipettes
- Watch glasses (ribbed & non-ribbed)
- Filters and plunger apparatus
- 100 & 50 mL digestate vessels (which are checked to ensure volume markings are within 2.5% Tolerance).
- 100 mL Snap-Cap containers for digestates (which are checked to ensure volume markings are within 2.5% Tolerance).

5.0 REAGENTS AND STANDARDS

5.1 Reagents

- Concentrated Nitric Acid (Instra Pure)
- Concentrated Hydrochloric Acid (Instra Pure)
- 30% Hydrogen Peroxide Solution

Purchased from a chemical vendor.

- Life of Reagent: Specified by the Manufacturer, usually 1 year.
- Storage Requirements: Acid Cabinet

5.2 Standards

5.2.1 Trace ICP and GFAA Intermediate Standards

These standards are prepared from multi-element solutions purchased from vendors. Single element spikes may be used if needed. These solutions expire 1-year from the date of receipt.

Standard	Preparation
Trace ICP Spike Solution	• Add ~400 mLs of Milli-Q water to a 1-L Class A volumetric flask. • Add 100 mLs each of HP1381-A-500, HP1381-B-500 and HP1381-C-500; • Add 9 mLs of 1,000 ppm Se; • Add 8 mLs of 1,000 ppm Pb; • Add 6 mLs of 1,000 ppm As; • Add 5 mLs of 1,000 ppm Tl; and • Add 40 mLs of InstraPure nitric acid. • Swirl to mix; Dilute to volume with Milli-Q water. Life of Standard: Expiration date of the earliest expiring standard. Storage Requirements: None.
GFAA Spike Solution	• Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. • Add 20 mLs of nitric acid; • Add 10 mLs of STL-CLP-60R • Swirl to mix. Dilute to volume with Milli-Q water. Life of Standard: Expiration date of the earliest expiring standard. Storage Requirements: None.
GFAA Ag Spike Solution	• Add ~500 mLs of Milli-Q water to a 1-L Class A volumetric flask. • Add 20 mLs each of nitric acid and hydrogen peroxide. • Add 2 mLs of 1000 ppm Ag. • Swirl to mix. Dilute to volume with Milli-Q water. Life of Standard: As defined by the manufacturer. Storage Requirements: None.

Refer to Appendix A for the individual element concentrations within the spiking solutions. Matrix spikes for TCLP extracts are added after filtration of the TCLP extract and before preservation. Refer to SOP No. USP-1311.

6.0 CALIBRATION (NON-DAILY)

Not Applicable.

7.0 PROCEDURE

7.1 Quality Control Checks

QC Indicator	Preparation	Frequency
Method Blank (MB)	For soil sample batches, use 100 mLs of Milli-Q water.	1 per 20 or fewer samples.
	For water sample batches, use 50 mLs of Milli-Q water.	1 per 20 or fewer samples.
Matrix Duplicate (MD) [1]	Aliquot of the same field sample that is digested independently.	1 per 20 or fewer samples.
Laboratory Control Sample (LCS) [2]	For soil sample batches, use 100 mLs of Milli-Q water and spike as listed below. [3]	1 per 20 or fewer samples.
	For water sample batches, use 50 mLs of Milli-Q water and spike as listed below. [3]	1 per 20 or fewer samples.
Matrix Spike (MS); MS Duplicate (MSD) [1]	Aliquot of the same field sample that is spiked as listed below [3] and digested independently.	1 per 20 or fewer samples.

[1] The sample selection for MS/MSD/MD is rotated among client samples so that various matrix problems may be noted and/or addressed.
[2] LCS Duplicate (LCD) is performed when requested by the client, contract or QAP.

[3] The LCS and MS/MSD are spiked with a known amount of analyte and processed through the digestion procedure. The spiking procedure is as follows:

Instrument	Waters Spike Volume	Soils Spike Volume
Trace ICP	0.5 mL of Trace ICP Intermediate Spiking Solution.	1 mL of Trace ICP Intermediate Spiking Solution.
GFAA	0.5 mL of GFAA Intermediate Spiking Solution.	1 mL of GFAA Intermediate Spiking Solution.

Refer to Appendix A for the individual element concentrations within the spiking solutions. Matrix spikes for TCLP extracts are added after filtration of the TCLP extract and before preservation. Refer to USP-1311.

7.2 Sample Preservation and Storage

Matrix	Holding Time	Preservation
Waters	180 days	HNO_3, pH <2; Cool 4 $\pm$ 2°C
Soils	180 days	Cool 4 $\pm$ 2°C

7.2.1 Sample Handling Procedures (Other than Soils / Waters)

Matrix	Description
Wipes	The entire wipe is digested with results reported as ug/wipe.
Paint Chips	Care is taken to remove the paint from the substrate. The chips are then cut and ground into a fine powder. Sample size is 0.1 to 0.5 grams.
Solids *	Dried and ground with a mechanical crusher.

*Bricks, wood, etc..

7.3 Sample Preparation

- Since the pH is checked by the sample custodian at sample receipt, the digestion analysis will check the pH at random and/or if the analyst has a reason to suspect that the sample may not be preserved.
- The start and end temperature of the hot plate or hot block digestion is documented within LabNet.

NOTE: The LCS and MB must be filtered when analyzed with dissolved metals that are filtered in the laboratory (unpreserved samples).

7.4 Calibration / Standardization

Not Applicable.

7.5 Preventive Maintenance

- To minimize contamination during sample preparation, the fume hoods and counter areas must be kept clean and free of dust.
- The digestion hoods are cleaned on a regular basis (a minimum of once a month) and documented within the hood maintenance log.

7.6 Sample Digestion

7.6.1 Method 3005A

- Transfer 50 mLs of the well-mixed (homogenized) sample into a 50 mL digestion vessel.
- Add 1 mLs of InstraPure nitric acid and 2.5 mLs of InstraPure hydrochloric acid.
- Cover the vessel with a ribbed watch glass and heat on a preheated hot block at 90-95°C until the volume has been reduced to 10-15 mLs.
- Remove the vessels from the hot block and allow to cool.
- Fill to a 50 mL final volume in the digestion vessel with Milli-Q water and filter using the plunger apparatus.
- The sample is now ready for analysis.

NOTE: When using the Hot Plates, all volumes remain the same in the 250 mL beaker. When filtering, wash down the sides of the beaker with Milli-Q water and filter into a 50 mL volumetric flask through Whatman 541 filter paper. Dilute the sample to a final 50 mL volume using Milli-Q water.

7.6.2 Method 3010A

- Transfer 50 mLs of the well-mixed (homogenized) sample into a 50 mL digestion vessel.
- Add 1.5 mLs of InstraPure nitric acid.
- Cover the vessel with a ribbed watch glass and place on a preheated hot block set at 90-95°C.
- Evaporate the sample down to a low volume – just enough to cover the bottom of the vessel. **The sample should not boil or any portion of the vessel bottom allowed to go dry.**
- Remove the vessel from the hot block and allow to cool.
- Add another 1.5 mL portion of InstraPure nitric acid.
- Cover the vessel with a non-ribbed watch glass and return to the hot block to allow a gentle reflux to occur.
- Continue to add InstraPure nitric acid as necessary, until the digestion is complete (no change in appearance with continued refluxing).
- Uncover and evaporate to a low volume, not allowing any part of the vessel to go dry.
- Remove the vessels from the hot block and allow to cool.
- Add 2.5 mLs of InstraPure hydrochloric acid and 2.5 mLs of Milli-Q water.
- Warm the vessel for another 15 minutes to dissolve any precipitate.
- Remove from hot block and allow to cool.
- Fill to a 50 mL final volume in the digestion vessel with Milli-Q water and filter using plunger apparatus.
- The sample is now ready for analysis.

NOTE: When using the Hot Plate, the volume remains the same in a 250 mL beaker. When filtering wash down the sides of the beaker with Milli-Q water and filter the sample into a 50 mL volumetric flask through Whatman 541 filter paper. Dilute to the 50 mL final volume with Milli-Q water.

7.6.3 Method 3020A

- Transfer 50 mLs of the well-mixed (homogenized) sample into a 50 mL digestion vessel.
- Add 1.5 mLs of InstraPure nitric acid.
- Cover the vessel with a ribbed watch glass and place on a preheated hot block set at 90-95°C.
- Evaporate the sample down to a low volume – just enough to cover the bottom of the vessel. **The sample should not boil or any portion of the vessel bottom allowed to go dry.**
- Remove the vessels from the hot block and allow to cool.
- Add another 1.5 mL portion of InstraPure nitric acid.
- Cover the vessel with a non-ribbed watch glass and return to the hot block to allow a gentle reflux to occur.
- Continue to add InstraPure nitric acid as necessary, until the digestion is complete (no change in appearance with continued refluxing).
- Uncover and evaporate to a low volume, not allowing any part of the vessel to go dry.
- Remove the vessel from the hot block and allow to cool.
- Add 5 mLs of Milli-Q water and continue warming for 10-15 minutes to dissolve any precipitates.
- Remove from the hot block and allow to cool.
- Fill to a final 50 mL volume in the digestion vessel with Milli-Q water and filter using plunger apparatus.
- The sample is now ready for analysis.

NOTE: When using the Hot Plate, all volumes remain the same in 250 mL beaker. When filtering wash down the sides of the beaker with Milli-Q water and filter the sample into a 50 mL volumetric flask through Whatman 541 filter paper. Dilute to the 50 mL final volume with Milli-Q water.

7.6.4 Method 3020A Modified

This method is equivalent to Method 3020A, however, 1 mL of hydrogen peroxide is added to the sample with the initial 1.5 mLs of nitric acid.

7.6.5 Method 3050B

- Weigh out 1.00 – 2.00 grams of the well-mixed sample into a 250 mL beaker. The exact weight is recorded in the LabNet digestion spreadsheet.
- For samples with a high liquid content, more sample may be used as long as the digestion is complete.

NOTE: When using the hot blocks, soils are generally weighed to 1.00-1.20 grams due to the size of the digestion vessels. All other volumes are the same as for the hot plate/beaker digestions.

Add 5 mLs of InstraPure nitric acid and 5 mLs of Milli-Q water.

- Cover the beaker with a non-ribbed watch glass and place on a preheated hotplate set at 90-95°C for 15 minutes without boiling.
- Remove the beaker from the hot plate and allow to cool.
- Add 5 mLs of InstraPure nitric acid and reflux for 30 minutes.
- If brown fumes are generated, repeat this last step until no brown fumes are generated indicating complete reaction with the nitric acid.
- Allow the solution to evaporate to a low volume – just enough to cover the bottom of the beaker. **Do not allow the sample to boil.**
- Remove the beaker from the hot plate and allow to cool.
- Add 2 mLs of Milli-Q water and 3 mLs of 30% hydrogen peroxide.
- Cover the beaker and heat until the reaction is complete.
- Remove the beaker from the hot plate and allow to cool.
- Continue to add 30% hydrogen peroxide in 1 mL aliquots with warming until the effervescence is minimal or until the general sample appearance in unchanged. **Do not add more than a total of 10 mLs of hydrogen peroxide.**
- Cover the sample with a ribbed watch glass and heat until the volume has been reduced to ~5mLs or heat at 90-95°C for 2-hours without boiling.
- Maintain a covering of solution on the bottom of the beaker at all times.

****

If the sample is being analyzed by the Trace ICP:

- Allow the sample to cool.
- Add 10 mLs of InstraPure hydrochloric acid.
- Place the beaker on the hot plate and heat for 15 minutes without boiling.
- Remove the beaker from the hot plate and allow to cool.
- Wash down the sides of the beaker with Milli-Q water and filter into a 100 mL snap-cap container through Whatman 541 filter paper.
- Dilute the sample to the 100 mL mark in a snap-cap container.
- The sample is now ready for analysis.

If the sample is being analyzed by GFAA:

- Allow the sample to cool.
- Wash down the sides of the beaker with Milli-Q water and filter into a 100 mL Class A volumetric flask through Whatman 541 filter paper.
- Dilute the sample to the 100 mL snap-cap container through Whatman 541 filter paper.
- The sample is now ready for analysis.

7.6.6 Methods 7060A / 7740

- Transfer 50 mLs of the well-mixed (homogenized) sample into a 50 mL digestion vessel.
- Add 1 mL of Hydrogen Peroxide and 0.5 mL of InstraPure nitric acid.
- Place the vessel on a preheated hot block set at 90-95°C.
- Evaporate the sample down to a volume slightly less than 25 mLs.
- Remove the samples and allow to cool.
- Fill to a final 50 mL volume in the digestion vessel with Milli-Q water and filter using the plunger apparatus.
- The sample is now ready for analysis.

NOTE: When using the Hot Plate, all volume remains the same in a 250 mL beaker. When filtering, wash down the sides of the beaker with Milli-Q water. Filter the sample through Whatman 541 filter paper into a 50 mL volumetric flask. Dilute to volume with Milli-Q water.

7.7 Documentation

7.7.1 LabNet Digestion Spreadsheets

Sample digestion and standard traceability are documented within the LabNet spreadsheets. The spreadsheets must be completed for each days work. The time of digestion and temperature of the hot plate/block must be recorded. Refer to Appendix B for an examples of the GFAA and Trace ICP digestion spreadsheets.

7.7.2 Traceability of Standards

Custom made and single element stock standard solutions which are traceable to NIST or EPA are purchased. Upon receipt, each standard is entered into the LabNet database and is issued a unique source ID#. The manufacturer, lot #, date received, expiration date, and the initials of the analyst are also entered.

8.0 QUALITY CONTROL

8.1 QC Summary

QC Standard	Indicator
Method Blank (MB)	Examined to determine if there was any contamination introduced during the digestion process.
Laboratory Control Sample (LCS)	Used to determine the completeness of the digestion process. The accuracy is measured by the percent recovery (%R) of each standard.
Matrix Duplicate (MD)	Demonstrate analytical precision and is reported as Relative Percent Difference (RPD).
Matrix Spike (MS) / MS Duplicate (MSD)	Used to demonstrate analytical accuracy and is reported as % recovery.

8.2 Corrective Action

Since this is a preparation procedure, out-of-control situations will not be identified until the filtrates are analyzed. Refer to the analytical SOPs for corrective actions.

9.0 DATA ANALYSIS AND CALCULATIONS

Not Applicable.

10.0 WASTE MANAGEMENT AND POLLUTION PREVENTION

All waste will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this method and the policies in section 13 of the Corporate Safety Manual for "Waste Management and Pollution Prevention."

10.1 Waste Streams Produced by the Method

- Waste from this procedure will enter the "Corrosive Wastewater" wastestream.

11.0 METHOD PERFORMANCE CRITERIA

Refer to sections 1, 6, 7 and 8.

12.0 REFERENCES

Refer to Section 1.0.

13.0 ATTACHMENTS

Appendix A. Metals Digestion Standard Spike Concentrations
Appendix B. Example: GFAA and Trace ICP LabNet Digestion Spreadsheets

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Historical File:

Revision 00: 08/15/91	Revision 07: 10/16/97
Revision 01: 03/16/93	Revision 08: 03/31/99
Revision 02: 08/20/93	Revision 09: 05/05/00
Revision 03: 01/20/94	Revision 10: 07/06/01
Revision 04: 11/22/95	Revision 11: 01/09/03
Revision 05: 02/18/97	Revision 12: 01/07/04
Revision 06: 10/07/97	Revision 13: 02/11/05

Reasons for Change, Revision 13:
- Annual Review – No Changes

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Appendix A.

Metals Digestion Standard Spike Concentration

Trace-ICP

Vendor	Stock Name	Elements	Conc. (mg/L)
Environmental Express	HP1381-A-500	Al, Ba	2,000
		Ca, Mg, K, Na	10,000
	HP1381-B-500	Se	10
		Pb	20
		As	40
		Tl, Be, Cd	50
		Cr	200
		Cu	250
		Co, Ni, Li, V, Bi, Mn, Zn	500
		B, Fe, Sr	1,000
	HP1381-C-500	Ag	50
		Sb, P	500
		Mo, Sn, Ti	1,000
		Si	5,000
Inorganic Ventures	Single Element Standard	As	1,000
		Pb	1,000
		Se	1,000
		Tl	1,000

GFAA

Vendor	Stock Name	Elements	Conc. (mg/L)
Inorganic Ventures	STL-CLP-60R	Sb, Tl	500
		As	400
		Cr, Cu, Pb	200
		Se	100
		Cd	50
	Single Element Standard	Ag	1,000

TCLP (MS)

Vendor	Stock Name	Elements	Conc. (mg/L)
Inorganic Ventures	STL-TCLP-1A	Hg	25
		Cu	25
		Zn, Ni	50
		Cd, Se, Ag	100
		Cr, As, Pb	500
	Single Element Standard	Ba	10,000

Appendix B.

Example: LabNet Digestion Spreadsheets

*** RUN LOG *** (V2)

2/15/05 9:39

Acid Digestion (ICAP)
Method Code..: 3005
Batch Code...: 139935

Status.......: RVWD
Batch Date...: 01/21/05
Batch Time...: 1013

User Name......: crb
QC Code........:
Calc Code......: PFACW

Location Code..: 57222
Equipment Code.:
Import Code....:

SAMPLE: Grp	Pos	Sample ID	Dilution	TEST CODE / TEST POS / Date / Time	DIGTR 1
1	1	___MB_139935_		1/21/05 0920	0
1	2	___LCS_M04LSPK003_		1/21/05 0920	0
1	3	233622_1____		1/21/05 0920	0
1	4	233622_1_D___		1/21/05 0920	0
1	5	233622_2____		1/21/05 0920	0
1	6	233622_2_D___		1/21/05 0920	0
1	7	233622_3____		1/21/05 0920	0
1	8	233622_3_D___		1/21/05 0920	0
1	9	233622_4____		1/21/05 0920	0
1	10	233622_4__MD__9		1/21/05 0920	0
1	11	233622_4__MS_M04LSPK003_9		1/21/05 0920	0
1	12	233622_4__MSD_M04LSPK003_9		1/21/05 0920	0
1	13	233622_4_D___		1/21/05 0920	0
1	14	233622_4_D_MD__13		1/21/05 0920	0
1	15	233622_4_D_MS_M04LSPK003_13		1/21/05 0920	0
1	16	233622_4_D_MSD_M04LSPK003_13		1/21/05 0920	0
1	17	233622_5____		1/21/05 0920	0
1	18	233622_5_D___		1/21/05 0920	0
1	19	233622_6____		1/21/05 0920	0
1	20	233622_6_D___		1/21/05 0920	0
1	21	233622_7____		1/21/05 0920	0
1	22	233622_7_D___		1/21/05 0920	0
1	23	233622_8____		1/21/05 0920	0
1	24	233622_8_D___		1/21/05 0920	0
1	25	233622_9____		1/21/05 0920	0
1	26	233622_9_D___		1/21/05 0920	0
1	27	_____			

*** BATCH WORKSHEET *** (V2)

Acid Digestion (ICAP) Report Date: 2/15/05 9:39

Method Code..: 3005	Batch Date...: 01/21/05	QC Code.......:	Equipment Code.:
Batch Code...: 139935	Batch Time...: 1013	Calc Code......: PFACW	Import Code....:
Status.......: RVWD	User Name....: crb	Location Code..: 57222	

BATCH:	Item	Description	Description Information
	1	Analyst:	crb
	2	Reviewer:	lmr
	3	Prep Time Start:	9:20
	4	Hot Plate #	1154
	5	Temperature oC Initial:	95
	6	Temperature oC Final:	95
	7	Repipettor Volume Check:	ok
	8	HNO3 Preservative Lot #	n/a
	9	HNO3 (Conc.) Lot #	a37042
	10	H2O2 (Conc.) Lot #	n/a
	11	HCL (Conc.) Lot #	a33046
	12	Comment:	622-sb,ba,be,cd,cr,co,pb,ni,
	13	Comment:	se,v-total
	14	Comment:	soluble the same plus-fe,mn

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGTR Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
	1	1	___MB_139935_		Complete	50	50	1.0000	1.000
	1	2	___LCS_M04LSPK003_		Complete	50	50	1.0000	1.000
	1	3	233622_1____		Complete	50	50	1.0000	1.000
	1	4	233622_1_D___		Complete	50	50	1.0000	1.000
	1	5	233622_2____		Complete	50	50	1.0000	1.000
	1	6	233622_2_D___		Complete	50	50	1.0000	1.000
	1	7	233622_3____		Complete	50	50	1.0000	1.000
	1	8	233622_3_D___		Complete	50	50	1.0000	1.000
	1	9	233622_4____		Complete	50	50	1.0000	1.000
	1	10	233622_4__MD__9		Complete	50	50	1.0000	1.000
	1	11	233622_4__MS_M04LSPK003_9		Complete	50	50	1.0000	1.000
	1	12	233622_4__MSD_M04LSPK003_9		Complete	50	50	1.0000	1.000
	1	13	233622_4_D___		Complete	50	50	1.0000	1.000
	1	14	233622_4_D_MD__13		Complete	50	50	1.0000	1.000
	1	15	233622_4_D_MS_M04LSPK003_13		Complete	50	50	1.0000	1.000
	1	16	233622_4_D_MSD_M04LSPK003_13		Complete	50	50	1.0000	1.000
	1	17	233622_5____		Complete	50	50	1.0000	1.000

Acid Digestion (ICAP) Report Date: 2/15/05 9:39

Method Code..: 3005	Batch Date...: 01/21/05	QC Code........:	Equipment Code.:
Batch Code...: 139935	Batch Time...: 1013	Calc Code......: PFACW	Import Code....:
Status.......: RVWD	User Name....: crb	Location Code..: 57222	

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGTR Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
	1	18	233622_5_D___		Complete	50	50	1.0000	1.000
	1	19	233622_6____		Complete	50	50	1.0000	1.000
	1	20	233622_6_D___		Complete	50	50	1.0000	1.000
	1	21	233622_7____		Complete	50	50	1.0000	1.000
	1	22	233622_7_D___		Complete	50	50	1.0000	1.000
	1	23	233622_8____		Complete	50	50	1.0000	1.000
	1	24	233622_8_D___		Complete	50	50	1.0000	1.000
	1	25	233622_9____		Complete	50	50	1.0000	1.000
	1	26	233622_9_D___		Complete	50	50	1.0000	1.000
	1	27	_____						

SAMPLE:	Grp	Pos	Sample ID	Dilution	VOL mL	COLORB Text	COLORF Text	CLARIB Text	CLARIF Text
	1	1	___MB_139935_		50				
	1	2	___LCS_M04LSPK003_		50				
	1	3	233622_1____		50				
	1	4	233622_1_D___		50				
	1	5	233622_2____		50				
	1	6	233622_2_D___		50				
	1	7	233622_3____		50				
	1	8	233622_3_D___		50				
	1	9	233622_4____		50				
	1	10	233622_4__MD__9		50				
	1	11	233622_4__MS_M04LSPK003_9		50				
	1	12	233622_4__MSD_M04LSPK003_9		50				
	1	13	233622_4_D___		50				
	1	14	233622_4_D_MD__13		50				
	1	15	233622_4_D_MS_M04LSPK003_13		50				
	1	16	233622_4_D_MSD_M04LSPK003_13		50				
	1	17	233622_5____		50				
	1	18	233622_5_D___		50				
	1	19	233622_6____		50				
	1	20	233622_6_D___		50				
	1	21	233622_7____		50				

Acid Digestion (ICAP)

Report Date: 2/15/05 9:39

Method Code..: 3005	Batch Date...: 01/21/05	QC Code........:	Equipment Code.:
Batch Code...: 139935	Batch Time...: 1013	Calc Code......: PFACW	Import Code....:
Status.......: RVWD	User Name....: crb	Location Code..: 57222	

SAMPLE:	Grp	Pos	Sample ID	Dilution	VOL mL	COLORB Text	COLORF Text	CLARIB Text	CLARIF Text
	1	22	233622_7_D___		50				
	1	23	233622_8____		50				
	1	24	233622_8_D___		50				
	1	25	233622_9____		50				
	1	26	233622_9_D___		50				
	1	27	_____						

SAMPLE:	Grp	Pos	Sample ID	Dilution	ARTIFA Text				
	1	1	___MB_139935_						
	1	2	___LCS_M04LSPK003_						
	1	3	233622_1____						
	1	4	233622_1_D___						
	1	5	233622_2____						
	1	6	233622_2_D___						
	1	7	233622_3____						
	1	8	233622_3_D___						
	1	9	233622_4____						
	1	10	233622_4__MD__9						
	1	11	233622_4__MS_M04LSPK003_9						
	1	12	233622_4__MSD_M04LSPK003_9						
	1	13	233622_4_D___						
	1	14	233622_4_D_MD__13						
	1	15	233622_4_D_MS_M04LSPK003_13						
	1	16	233622_4_D_MSD_M04LSPK003_13						
	1	17	233622_5____						
	1	18	233622_5_D___						
	1	19	233622_6____						
	1	20	233622_6_D___						
	1	21	233622_7____						
	1	22	233622_7_D___						
	1	23	233622_8____						
	1	24	233622_8_D___						
	1	25	233622_9____						

Acid Digestion (ICAP) Report Date: 2/15/05 9:39

Method Code..: 3005	Batch Date...: 01/21/05	QC Code........:	Equipment Code.:
Batch Code...: 139935	Batch Time...: 1013	Calc Code......: PFACW	Import Code....:
Status.......: RVWD	User Name....: crb	Location Code..: 57222	

SAMPLE:	Grp	Pos	Sample ID	Dilution	ARTIFA Text				
	1	26	233622_9_D___						
	1	27	____						

2/15/05 9:42

Acid Digestion (ICAP)
Method Code..: 3010
Batch Code...: 141789

Status.......: RVWD
Batch Date...: 02/11/05
Batch Time...: 1140

User Name......: crb
QC Code........:
Calc Code......: PFACW

Location Code..: 57222
Equipment Code.:
Import Code....:

SAMPLE: Grp	Pos	Sample ID	Dilution	TEST CODE / TEST POS / Date / Time	DIGICP 1
1	1	___MB_141789_		2/11/05 0950	0
1	2	___LCS_M05BSPK001_		2/11/05 0950	0
1	3	234141_1____		2/11/05 0950	0
1	4	234141_2____		2/11/05 0950	0
1	5	234173_1____		2/11/05 0950	0
1	6	234173_1__MD__5		2/11/05 0950	0
1	7	234173_1__MS_M05BSPK001_5		2/11/05 0950	0
1	8	234173_1__MSD_M05BSPK001_5		2/11/05 0950	0
1	9	234173_2____		2/11/05 0950	0
1	10	234173_3____		2/11/05 0950	0
1	11	234173_4____		2/11/05 0950	0
1	12	234173_5____		2/11/05 0950	0
1	13	234173_6____		2/11/05 0950	0
1	14	234173_7____		2/11/05 0950	0
1	15	234192_1____		2/11/05 0950	0
1	16	234192_2____		2/11/05 0950	0
1	17	_____			
1	18	_____			

Acid Digestion (ICAP) Report Date: 2/15/05 9:42

Method Code..: 3010	Batch Date...: 02/11/05	QC Code........:	Equipment Code.:
Batch Code...: 141789	Batch Time...: 1140	Calc Code......: PFACW	Import Code....:
Status.......: RVWD	User Name....: crb	Location Code..: 57222	

BATCH:	Item	Description	Description Information
	1	Analyst:	crb
	2	Reviewer:	lmr
	3	Prep Time Start:	9:50
	4	Hot Plate #	1154
	5	Temperature oC Initial:	95
	6	Temperature oC Final:	95
	7	Repipettor Volume Check:	ok
	8	HNO3 Preservative Lot #	n/a
	9	HNO3 (Conc.) Lot #	a45036
	10	H2O2 (Conc.) Lot #	n/a
	11	HCL (Conc.) Lot #	a48034
	12	Comment:	141-#1,2-ba,be,b,cd,cr,co,fe,
	13	Comment:	pb,mn,ni,ag,zn,cu
	14	Comment:	173-ba 192-cr,fe,mn,ni

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGICP Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
	1	1	___MB_141789_		Complete	50	50	1.0000	1.000
	1	2	___LCS_M05BSPK001_		Complete	50	50	1.0000	1.000
	1	3	234141_1____		Complete	50	50	1.0000	1.000
	1	4	234141_2____		Complete	50	50	1.0000	1.000
	1	5	234173_1____		Complete	50	50	1.0000	1.000
	1	6	234173_1__MD__5		Complete	50	50	1.0000	1.000
	1	7	234173_1__MS_M05BSPK001_5		Complete	50	50	1.0000	1.000
	1	8	234173_1__MSD_M05BSPK001_5		Complete	50	50	1.0000	1.000
	1	9	234173_2____		Complete	50	50	1.0000	1.000
	1	10	234173_3____		Complete	50	50	1.0000	1.000
	1	11	234173_4____		Complete	50	50	1.0000	1.000
	1	12	234173_5____		Complete	50	50	1.0000	1.000
	1	13	234173_6____		Complete	50	50	1.0000	1.000
	1	14	234173_7____		Complete	50	50	1.0000	1.000
	1	15	234192_1____		Complete	50	50	1.0000	1.000
	1	16	234192_2____		Complete	50	50	1.0000	1.000
	1	17	____						

Acid Digestion (ICAP) Report Date: 2/15/05 9:42

Method Code..: 3010	Batch Date...: 02/11/05	QC Code........:	Equipment Code.:
Batch Code...: 141789	Batch Time...: 1140	Calc Code......: PFACW	Import Code....:
Status.......: RVWD	User Name....: crb	Location Code..: 57222	

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGICP Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
	1	18	_____						

SAMPLE:	Grp	Pos	Sample ID	Dilution	VOL mL	COLORB Text	COLORF Text	CLARIB Text	CLARIF Text
	1	1	___MB_141789_		50				
	1	2	___LCS_M05BSPK001_		50				
	1	3	234141_1____		50				
	1	4	234141_2____		50				
	1	5	234173_1____		50				
	1	6	234173_1__MD__5		50				
	1	7	234173_1__MS_M05BSPK001_5		50				
	1	8	234173_1__MSD_M05BSPK001_5		50				
	1	9	234173_2____		50				
	1	10	234173_3____		50				
	1	11	234173_4____		50				
	1	12	234173_5____		50				
	1	13	234173_6____		50				
	1	14	234173_7____		50				
	1	15	234192_1____		50				
	1	16	234192_2____		50				
	1	17	_____						
	1	18	_____						

SAMPLE:	Grp	Pos	Sample ID	Dilution	ARTIFA Text				
	1	1	___MB_141789_						
	1	2	___LCS_M05BSPK001_						
	1	3	234141_1____						
	1	4	234141_2____						
	1	5	234173_1____						
	1	6	234173_1__MD__5						
	1	7	234173_1__MS_M05BSPK001_5						
	1	8	234173_1__MSD_M05BSPK001_5						
	1	9	234173_2____						
	1	10	234173_3____						

Acid Digestion (ICAP) Report Date: 2/15/05 9:42

Method Code..: 3010 Batch Date...: 02/11/05 QC Code........: Equipment Code.:
Batch Code...: 141789 Batch Time...: 1140 Calc Code......: PFACW Import Code....:
Status.......: RVWD User Name....: crb Location Code..: 57222

SAMPLE:	Grp	Pos	Sample ID	Dilution	ARTIFA Text				
	1	11	234173_4____						
	1	12	234173_5____						
	1	13	234173_6____						
	1	14	234173_7____						
	1	15	234192_1____						
	1	16	234192_2____						
	1	17	_____						
	1	18	_____						

2/15/05 9:45

Acid Digestion with H2O2 (GFAA)
Method Code..: 3020M
Batch Code...: 141731

Status.......: RVWD
Batch Date...: 02/10/05
Batch Time...: 2055

User Name......: rlc
QC Code........:
Calc Code......: PFACW

Location Code..: 57222
Equipment Code.:
Import Code....:

SAMPLE: Grp	Pos	Sample ID	Dilution	TEST CODE / TEST POS / Date / Time	DIGGFA 1
1	1	___MB_141731_		2/10/05 1900	0
1	2	___LCS_M04LSPK002_		2/10/05 1900	0
1	3	234106_1____		2/10/05 1900	0
1	4	234106_2____		2/10/05 1900	0
1	5	234106_3____		2/10/05 1900	0
1	6	234106_4____		2/10/05 1900	0
1	7	234106_5____		2/10/05 1900	0
1	8	234106_6____		2/10/05 1900	0
1	9	234106_7____		2/10/05 1900	0
1	10	234106_8____		2/10/05 1900	0
1	11	234106_9____		2/10/05 1900	0
1	12	234106_10____		2/10/05 1900	0
1	13	234106_11____		2/10/05 1900	0
1	14	234106_12____		2/10/05 1900	0
1	15	234122_7____		2/10/05 1900	0
1	16	234122_8____		2/10/05 1900	0
1	17	234122_17____		2/10/05 1900	0
1	18	234141_1____		2/10/05 1900	0
1	19	234141_2____		2/10/05 1900	0
1	20	234141_2__MD__19		2/10/05 1900	0
1	21	234141_2__MS_M04LSPK002_19		2/10/05 1900	0
1	22	234141_2__MSD_M04LSPK002_19		2/10/05 1900	0
1	23	234153_3____		2/10/05 1900	0

*** BATCH WORKSHEET *** (V2)

Acid Digestion with H2O2 (GFAA)

Report Date: 2/15/05 9:45

Method Code..: 3020M	Batch Date...: 02/10/05	QC Code........:	Equipment Code.:
Batch Code...: 141731	Batch Time...: 2055	Calc Code......: PFACW	Import Code....:
Status.......: RVWD	User Name....: rlc	Location Code..: 57222	

BATCH:	Item	Description	Description Information
	1	Analyst:	rlc
	2	Reviewer:	lmr
	3	Prep Time Start:	1900
	4	Hot Plate #	1565
	5	Temperature oC Initial:	95
	6	Temperature oC Final:	95
	7	Repipettor Volume Check:	ok
	8	HNO3 Preservative Lot #	n/a
	9	HNO3 (Conc.) Lot #	a45036
	10	H2O2 (Conc.) Lot #	a24a02
	11	HCL (Conc.) Lot #	n/a
	12	Comment:	GFAA + GFAA Ag 234106-Sb,Tl
	13	Comment:	234122-Tl (CLP-like) 234141-
	14	Comment:	Sb,As,Se,Tl 234153-Se

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGGFA Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
	1	1	___MB_141731_		Complete	50	50	1.0000	1.000
	1	2	___LCS_M04LSPK002_		Complete	50	50	1.0000	1.000
	1	3	234106_1____		Complete	50	50	1.0000	1.000
	1	4	234106_2____		Complete	50	50	1.0000	1.000
	1	5	234106_3____		Complete	50	50	1.0000	1.000
	1	6	234106_4____		Complete	50	50	1.0000	1.000
	1	7	234106_5____		Complete	50	50	1.0000	1.000
	1	8	234106_6____		Complete	50	50	1.0000	1.000
	1	9	234106_7____		Complete	50	50	1.0000	1.000
	1	10	234106_8____		Complete	50	50	1.0000	1.000
	1	11	234106_9____		Complete	50	50	1.0000	1.000
	1	12	234106_10____		Complete	50	50	1.0000	1.000
	1	13	234106_11____		Complete	50	50	1.0000	1.000
	1	14	234106_12____		Complete	50	50	1.0000	1.000
	1	15	234122_7____		Complete	50	50	1.0000	1.000
	1	16	234122_8____		Complete	50	50	1.0000	1.000
	1	17	234122_17____		Complete	50	50	1.0000	1.000

Acid Digestion with H202 (GFAA)

Report Date: 2/15/05 9:45

Method Code..: 3020M	Batch Date...: 02/10/05	QC Code........:	Equipment Code.:
Batch Code...: 141731	Batch Time...: 2055	Calc Code......: PFACW	Import Code....:
Status.......: RVWD	User Name....: rlc	Location Code..: 57222	

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGGFA Text	MLI mL	MLF mL	PREPF N/A	DLFAC N/A
	1	18	234141_1____		Complete	50	50	1.0000	1.000
	1	19	234141_2____		Complete	50	50	1.0000	1.000
	1	20	234141_2__MD__19		Complete	50	50	1.0000	1.000
	1	21	234141_2__MS_M04LSPK002_19		Complete	50	50	1.0000	1.000
	1	22	234141_2__MSD_M04LSPK002_19		Complete	50	50	1.0000	1.000
	1	23	234153_3____		Complete	50	50	1.0000	1.000

SAMPLE:	Grp	Pos	Sample ID	Dilution	VOL mL	COLORB Text	COLORF Text	CLARIB Text	CLARIF Text
	1	1	___MB_141731_		50				
	1	2	___LCS_M04LSPK002_		50				
	1	3	234106_1____		50				
	1	4	234106_2____		50				
	1	5	234106_3____		50				
	1	6	234106_4____		50				
	1	7	234106_5____		50				
	1	8	234106_6____		50				
	1	9	234106_7____		50				
	1	10	234106_8____		50				
	1	11	234106_9____		50				
	1	12	234106_10____		50				
	1	13	234106_11____		50				
	1	14	234106_12____		50				
	1	15	234122_7____		50	colorless	colorless	clear	clear
	1	16	234122_8____		50	colorless	colorless	clear	clear
	1	17	234122_17____		50	colorless	colorless	clear	clear
	1	18	234141_1____		50				
	1	19	234141_2____		50				
	1	20	234141_2__MD__19		50				
	1	21	234141_2__MS_M04LSPK002_19		50				
	1	22	234141_2__MSD_M04LSPK002_19		50				
	1	23	234153_3____		50				

SAMPLE:	Grp	Pos	Sample ID	Dilution	ARTIFA Text

Acid Digestion with H2O2 (GFAA)

Report Date: 2/15/05 9:45

Method Code..: 3020M	Batch Date...: 02/10/05	QC Code........:	Equipment Code.:
Batch Code...: 141731	Batch Time...: 2055	Calc Code......: PFACW	Import Code....:
Status.......: RVWD	User Name....: rlc	Location Code..: 57222	

SAMPLE:	Grp	Pos	Sample ID	Dilution	ARTIFA Text				
	1	1	___MB_141731_						
	1	2	___LCS_M04LSPK002_						
	1	3	234106_1____						
	1	4	234106_2____						
	1	5	234106_3____						
	1	6	234106_4____						
	1	7	234106_5____						
	1	8	234106_6____						
	1	9	234106_7____						
	1	10	234106_8____						
	1	11	234106_9____						
	1	12	234106_10____						
	1	13	234106_11____						
	1	14	234106_12____						
	1	15	234122_7____						
	1	16	234122_8____						
	1	17	234122_17____						
	1	18	234141_1____						
	1	19	234141_2____						
	1	20	234141_2__MD__19						
	1	21	234141_2__MS_M04LSPK002_19						
	1	22	234141_2__MSD_M04LSPK002_19						
	1	23	234153_3____						

2/15/05 9:47

Acid Digestion: Solids (ICAP)
Method Code..: 3050
Batch Code...: 141667

Status.......: RVWD
Batch Date...: 02/10/05
Batch Time...: 1142

User Name......: crb
QC Code........:
Calc Code......: PFACS

Location Code..: 57222
Equipment Code.:
Import Code....:

SAMPLE: Grp	Pos	Sample ID	Dilution	TEST CODE / TEST POS / Date / Time	DIGSOL 1
1	1	__S_MB_141667_		2/10/05 1210	0
1	2	__S_LCS_M05BSPK001_		2/10/05 1210	0
1	3	234125_1_S___		2/10/05 1210	0
1	4	234126_2_S___		2/10/05 1210	0
1	5	234126_2_S_MD__4		2/10/05 1210	0
1	6	234126_2_S_MS_M05BSPK001_4		2/10/05 1210	0
1	7	234126_2_S_MSD_M05BSPK001_4		2/10/05 1210	0
1	8	234126_4_S___		2/10/05 1210	0
1	9	234126_6_S___		2/10/05 1210	0
1	10	234126_8_S___		2/10/05 1210	0

*** BATCH WORKSHEET *** (V2)

Acid Digestion: Solids (ICAP)

Report Date: 2/15/05 9:47

Method Code..: 3050	Batch Date...: 02/10/05	QC Code........:	Equipment Code.:
Batch Code...: 141667	Batch Time...: 1142	Calc Code......: PFACS	Import Code....:
Status.......: RVWD	User Name....: crb	Location Code..: 57222	

BATCH:	Item	Description	Description Information
	1	Analyst:	crb
	2	Reviewer:	lmr
	3	Prep Time Start:	12:10
	4	Hot Plate #	1740
	5	Temperature oC Initial:	95
	6	Temperature oC Final:	95
	7	Repipettor Volume Check:	ok
	8	HNO3 Preservative Lot #	n/a
	9	HNO3 (Conc.) Lot #	a45036
	10	H2O2 (Conc.) Lot #	a45a09
	11	HCL (Conc.) Lot #	a48034
	12	Comment:	125-k
	13	Comment:	126-hsl
	14	Comment:	

SAMPLE:	Grp	Pos	Sample ID	Dilution	DIGSOL Text	WEIGHT g	MLF mL	PREPF N/A	DLFAC N/A
	1	1	__S_MB_141667_		Complete	1.000	100	100.0000	1.0000
	1	2	__S_LCS_M05BSPK001_		Complete	1.000	100	100.0000	1.0000
	1	3	234125_1_S___		Complete	1.041	100	96.0615	0.9606
	1	4	234126_2_S___		Complete	1.082	100	92.4214	0.9242
	1	5	234126_2_S_MD__4		Complete	1.086	100	92.0810	0.9208
	1	6	234126_2_S_MS_M05BSPK001_4		Complete	1.082	100	92.4214	0.9242
	1	7	234126_2_S_MSD_M05BSPK001_4		Complete	1.062	100	94.1620	0.9416
	1	8	234126_4_S___		Complete	1.106	100	90.4159	0.9042
	1	9	234126_6_S___		Complete	1.067	100	93.7207	0.9372
	1	10	234126_8_S___		Complete	1.091	100	91.6590	0.9166

SAMPLE:	Grp	Pos	Sample ID	Dilution	VOL mL	COLORB Text	COLORF Text	TEXTUR Text	ARTIFA Text
	1	1	__S_MB_141667_		100				
	1	2	__S_LCS_M05BSPK001_		100				
	1	3	234125_1_S___		100				
	1	4	234126_2_S___		100				
	1	5	234126_2_S_MD__4		100				

Acid Digestion: Solids (ICAP) Report Date: 2/15/05 9:47

Method Code..: 3050	Batch Date...: 02/10/05	QC Code........:	Equipment Code.:
Batch Code...: 141667	Batch Time...: 1142	Calc Code......: PFACS	Import Code....:
Status.......: RVWD	User Name....: crb	Location Code..: 57222	

SAMPLE:	Grp	Pos	Sample ID	Dilution	VOL mL	COLORB Text	COLORF Text	TEXTUR Text	ARTIFA Text
	1	6	234126_2_S_MS_M05BSPK001_4		100				
	1	7	234126_2_S_MSD_M05BSPK001_4		100				
	1	8	234126_4_S___		100				
	1	9	234126_6_S___		100				
	1	10	234126_8_S___		100				

Appendix. List of Cited SOPs and Work Instructions

Cited Sec. No(s)	Description	Document No.
5.4.3	Selection of Calibration Points	P-T-001
5.5.1	Balance Calibration, Care and Use	UQA-003
5.5.1; 5.7.1	Thermometer Calibrations and Electronic Monitoring	UQA-034
5.5.1	Water Quality	UQA-035
5.7.1	Sample Receipt: Handling and Processing	USR-001
5.7.5	Laboratory Waste Disposal Procedures	UWM-001
5.8.1	PT Sample Tracking/Analysis	UQA-018
5.8.5	Glassware Cleaning Procedures	UQA-009
5.9.5	EDD SOP	UIS-001
5.9; 5.9.6	Data Management: Process Operation	UDM-001

ATTACHMENT G

Reporting Limits

and Method Detection Limits

STL Reference Data Summary

Structured Analysis Code:	**A-82-1U-01-07**	Matrix:	SOLID
		Extraction:	LEACHATE, DI (Routine)
		Method:	Perchlorate (314.0)
Target Analyte List:	All Analytes	QC Program:	STANDARD TEST SET
		Location:	STL Sacramento

Analyte List			Detection Limits				Check List 20006							Spike List 20007						
Syn	**Compound**	**RL**	**Units**	**MDL**	**Units**	**Run Date**	**T**	**A**	**Amt**	**Units**	**LCL**	**UCL**	**RPD**	**T**	**A**	**Amt**	**Units**	**LCL**	**UCL**	**RPD**
5200	Perchlorate	40	ug/kg	3.39	ug/kg	20040126	C	Y	500	ug/kg	75	125	20	C	Y	500	ug/kg	75	125	20

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Structured Analysis Code: I-88-1U-01-07

Target Analyte List: All Analytes

Matrix: WATER
Extraction: NO SAMPLE PREPARATION PERFORMED / DIRECT INJI
Method: Perchlorate (314.0)
QC Program: STANDARD TEST SET
Location: STL Sacramento

Analyte List		Detection Limits					Check List 20006							Spike List 20007						
Syn	Compound	RL	Units	MDL	Units	Run Date	T	A	Amt	Units	LCL	UCL	RPD	T	A	Amt	Units	LCL	UCL	RPD
5200	Perchlorate	4.0	ug/L	0.339	ug/L	20040126	C	Y	50	ug/L	85	115	15	C	Y	50	ug/L	80	120	20

Method Limit Report for Project 20005335

Test Long Description	TMX	Units	RL	MDL	LCSLL	LCSUL	LCSRPD
Method: Perchlorates (314)							
Perchlorate	Solid	mg/Kg					
Method: Metals Analysis (ICAP Trace) (6010TR)							
Aluminum	Solid	mg/Kg	20.	5.05	80	120	20
Antimony	Solid	mg/Kg	2.0	0.43	80	120	20
Arsenic	Solid	mg/Kg	1.0	0.37	80	120	20
Barium	Solid	mg/Kg	1.0	0.072	80	120	20
Beryllium	Solid	mg/Kg	0.40	0.018	80	120	20
Cadmium	Solid	mg/Kg	0.20	0.058	80	120	20
Calcium	Solid	mg/Kg	10.	1.84	80	120	20
Chromium	Solid	mg/Kg	1.0	0.10	80	120	20
Cobalt	Solid	mg/Kg	0.50	0.12	80	120	20
Copper	Solid	mg/Kg	1.0	0.22	80	120	20
Iron	Solid	mg/Kg	10.	2.20	80	120	20
Lead	Solid	mg/Kg	0.50	0.25	80	120	20
Magnesium	Solid	mg/Kg	10.	1.01	80	120	20
Manganese	Solid	mg/Kg	1.0	0.053	80	120	20
Nickel	Solid	mg/Kg	1.0	0.48	80	120	20
Potassium	Solid	mg/Kg	50.	6.0	80	120	20
Selenium	Solid	mg/Kg	1.0	0.45	80	120	20
Silver	Solid	mg/Kg	0.50	0.10	80	120	20
Sodium	Solid	mg/Kg	100.	78.6	80	120	20
Thallium	Solid	mg/Kg	1.0	0.57	80	120	20
Vanadium	Solid	mg/Kg	0.50	0.15	80	120	20
Zinc	Solid	mg/Kg	2.0	1.37	80	120	20
Strontium	Solid	mg/Kg	0.50	0.39	80	120	20
Method: Mercury (CVAA) Solids (7471)							
Mercury	Solid	ug/Kg	16.7	6.1	80	120	20
Method: Explosives by 8330 (HPLC) (8330)							
HMX	Solid	ug/Kg	200.	30.2	86	117	30
RDX	Solid	ug/Kg	200.	33.3	90	115	30
1,3,5-Trinitrobenzene	Solid	ug/Kg	100.	7.0	82	125	30
1,3-Dinitrobenzene	Solid	ug/Kg	100.	5.0	86	112	30
Nitrobenzene	Solid	ug/Kg	100.	7.7	90	109	30
2,4,6-TNT	Solid	ug/Kg	100.	14.7	67	152	30
Tetryl	Solid	ug/Kg	250.	117.	60	130	30
2,4-Dinitrotoluene	Solid	ug/Kg	100.	7.9	87	114	30
2,6-Dinitrotoluene	Solid	ug/Kg	200.	10.0	90	112	30
2-Amino-4,6-Dinitrotoluene	Solid	ug/Kg	200.	6.4	90	112	30
4-Amino-2,6-Dinitrotoluene	Solid	ug/Kg	200.	85.6	88	119	30

Method Limit Report for Project 20005335

Test Long Description	TMX	Units	RL	MDL	LCSLL	LCSUL	LCSRPD
			Limits				
Method: Explosives by 8330 (HPLC) (8330)							
2-Nitrotoluene	Solid	ug/Kg	200.	17.0	88	114	30
4-Nitrotoluene	Solid	ug/Kg	200.	30.2	86	114	30
3-Nitrotoluene	Solid	ug/Kg	200.	11.6	89	115	30
Method: NG/PETN by 8332M (HPLC) (8332)							
Nitroglycerine	Solid	ug/Kg	200.	122.	74	142	30
PETN	Solid	ug/Kg	400.	142.	50	150	30
Method: % Solids Determination (SOLIDS)							
% Solids	Solid	%					
% Moisture	Solid	%					

ATTACHMENT H

Data Quality Objectives

Table I-8
Summary of measurement quality objectives for Method 8330 Explosives

Initial Calibration (I.9.2.2.8)	Primary Evaluation: r • 0.995, RSD • 20%, r^2 • 0.990	No allowance
	Alternative Evaluation: Mean %RSD for all target analytes • 20%, with maximum allowable restriction noted at right for individual analytes.	Alternative Evaluation: Maximum allowable %RSD for each individual target analyte • 40%
ICV (I.9.3)	%Rec = 85% - 115%	No allowance
CCV (I.9.5 / I.9.5.2)	Primary Evaluation: %Drift • 15%, %D • 15%	No allowance
	Alternative Evaluation: Mean %Drift/%D for all target analytes • 15%, with maximum allowable restriction noted at right for individual analytes.	Alternative Evaluation: Maximum allowable %Drift/%D for each individual target analyte • 30%
MB (I.10.2.1 / I.11.4.1)	Target Analytes: Analytes < one-half MRL	Not applicable
LCS (I.10.2.2 / I.11.4.2)	Water: %Rec = 60% - 120%[2] Solids:%Rec = 60% - 120%[2]	Sporadic Marginal Failures[1]: %Rec = 40% - 150%
MS (I.10.2.3 / I.11.4.3 / I.11.4.3.2)	%Rec = 50% - 140%[2]	Sporadic Marginal Failures[1]: %Rec = 40% - 150%
MSD/MD (I.10.2.4 / I.11.4.4)	RPD • 50%	RPD • 60%
Surrogates (I.10.2.5 / I.11.4.5)	Interference-Free Matrix: Water: %Rec = 60% - 140% Solids: %Rec = 50% - 150% Project Sample Matrix: %Rec = 50% - 150%	Not applicable
Target Analyte Confirmation (I.12.3)	RPD • 40%	RPD • 40%

[1] The number of sporadic marginal failure (SMF) allowances depends upon the number of target analytes reported from the analysis. For instance, if between 7 to 15 explosives are reported from the high-performance liquid chromatography analysis, 1 SMF is allowed to the expanded criteria presented for the LCS. If greater than 15 explosives are reported, 2 SMFs are allowed for the LCS. If the MS includes only a subset of compounds, allow only 1 SMF for this QC element.
[2] Due to the tendency for Tetryl to decompose, an expanded criteria may be applied at 45% - 140% for both water and soil matrices.

Table I-1
Summary of Measurement quality objectives for Method 6010 Inductively Coupled Plasma (ICP) Metals

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria
Initial Calibration (I.9.2.1.1)	Option 1- 1 std and blank, and a low-level check standard at MQL Option 2- 3 stds and blank	Daily	Option 1- Low-level check standard ± 20% Option 2- r • 0.995
Instrumental Precision (I.9.2.1.1)	%RSD 3 integrations (exposures)	Each calibration and calibration verification standards (ICV/CCV)	%RSD < 5%
Initial Calibration Verification (ICV) (I.9.3)	Midlevel (2nd source) verification	After initial calibration	%Recovery ± 10%
Initial Calibration Blank (ICB) (I.9.4)	Interference-free matrix to assess analysis contamination	After initial calibration	Analytes < MDL
Interelement Check Standards (ICS) (I.8.1)	ICS-A - interferents only ICS-B - interferents and target analytes	Beginning of analytical sequence	%Recovery ± 20% for target analytes
Continuing Calibration Blank (CCB) (I.9.4)	Interference-free matrix to assess analysis contamination	Every 10 samples and at end of analytical sequence	Analytes < MDL
Continuing Calibration Verification (CCV) (I.9.5 / I.9.5.1)	Midlevel verification	Every 10 samples and at end of analytical sequence	%Recovery ± 10%
Method Blank (MB) (I.10.2.1 / I.11.4.1)	Interference-free matrix to assess overall method contamination	1 per sample batch	Analytes < one-half MRL
Laboratory Control Sample (LCS) (I.10.2.2 / I.11.4.2)	Interference-free matrix containing all target analytes	1 per sample batch	%Rec = 80% - 120% Sporadic marginal failures[1]: %Rec = 60% - 140%
Matrix Spike (MS) (I.10.2.3 / I.11.4.3 / I.11.4.3.1)	Sample matrix spiked with all/subset of target analytes prior to digestion	1 per sample batch	%Rec = 75% - 125%
Matrix Duplicate (MD) or Matrix Spike Duplicate (MSD) (I.10.2.4 / I.11.4.4)	Refer to text for MD or MS.	1 per sample batch	RPD • 25%
Post Digestion Spike (PDS) (I.10.3.1 / I.11.4.6)	Sample digestate spiked with all/subset of target analytes	1 per sample batch on MS sample	%Rec = 75% - 125%
Serial Dilution (SD) (I.10.3.2)	1:4 dilution analyzed to assess matrix effects	As needed to assess new and unusual matrices	Agreement between undiluted and diluted results ± 10%
Method of Standard Additions (MSA) (I.12.2.1)	Method of quantitation	As needed for samples with suspected or confirmed matrix effects	r • 0.995

[1] The number of Sporadic Marginal Failure (SMF) allowances depends upon the number of target analytes reported from the analysis. For instance, if between 7 to 15 metals are reported from the ICP analysis, one (1) SMF is allowed to the expanded criteria presented. If greater than 15 metals are reported from the ICP analysis, two (2) SMFs are allowed.

Table I-2
Summary of Measurement quality objectives for Method 7010/7470/7471 Series GFAA/CVAA Metals

Quality Control Element	Description of Element	Frequency of Implementation	Acceptance Criteria
Initial Calibration (I.9.2.1.2)	3 stds and blank(GFAA) 5 stds and blank(CVAA)	Daily	r • 0.995
Instrumental Precision (I.9.2.1.2)	RPD of 2 injections	All standards, and ICV/CCV	RPD ± 10%
Initial Calibration Verification (ICV) (I.9.3)	Midlevel (2nd source) verification	After initial calibration	%Rec ± 10%
Initial Calibration Blank (ICB) (I.9.4)	Interference-free matrix to assess analysis contamination	After initial calibration	Analytes < MDL
Continuing Calibration Blank (CCB) (I.9.4)	Interference-free matrix to assess analysis contamination	Every 10 samples and at end of analytical sequence	Analytes < MDL
Continuing Calibration Verification (CCV) (I.9.5 / I.9.5.1)	Midlevel verification	Every 10 samples and at end of analytical sequence	%Rec ± 20%
Method Blank (MB) (I.10.2.1 / I.11.4.1)	Interference-free matrix to assess overall method contamination	1 per sample batch	Analytes < one-half MRL
Laboratory Control Sample (LCS) (I.10.2.2 / I.11.4.2)	Interference-free matrix containing target analytes	1 per sample batch	%Rec = 80% - 120%
Matrix Spike (MS) (I.10.2.3 / I.11.4.3 / I.11.4.3.1)	Sample matrix spiked with target analytes prior to digestion	1 per sample batch	%Rec = 80% - 120%
Matrix Duplicate (MD) or Matrix Spike Duplicate (MSD) (I.10.2.4 / I.11.4.4)	Refer to text for MD or MS.	1 per sample batch	RPD • 20%
Post Digestion Spike (PDS) (I.10.3.1 / I.11.4.6)	Sample digestate spiked with target analytes	Every sample	%Rec = 85% - 115%
Serial Dilution (SD) (I.10.3.2)	1:4 dilution analyzed to assess matrix effects	As needed to assess new and unusual matrices	Agreement between undiluted and diluted results ± 10%
Method of Standard Additions (MSA) (I.12.2.1)	Method of quantitation	As needed for samples with suspected or confirmed matrix effects	r • 0.995

Note: GFAA = Graphite furnace - atomic absorption spectroscopy.
CVAA = Cold vapor - atomic absorption.

Summary of Calibration and QC Procedures for Method 314.0

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
314.0	Perchlorate	Multipoint calibration for all analytes (minimum 5 standards are recommended)	Initial calibration prior to sample analysis	option 1 linear- RSD ≤15%	Correct problem then repeat initial calibration	Apply R to all results for all samples associated with the calibration
				option 2 linear – least squares regression r > 0.995		
				option 3 non-linear – COD ≥ 0.990 (6 points will be used for second order, 7 points will be used for third order)		
		Second-source calibration verification – quality control sample	Once per multipoint calibration, upon reestablishing calibration, quarterly	Instrument response within ± 10% of expected value	Correct problem then repeat initial calibration	Apply R to all results for all samples associated with the calibration
		Instrument Performance Check (IPC)	Daily, before sample analysis	Conductance within 10% of original value (original value within ± 10% of MCT)	Prepare fresh IPC solution	Apply R to all results for the sample
				$\%D_{A/H}$ < 25%, instrument response within ± 20% of expected response	Redetermine MCT or correct problem and reanalyze IPC	
				Retention time shifts < 5%, or overall retention time < 80% of original recorded value	Correct problem, clean or replace column	
		Initial calibration verification	Daily, before sample analysis or when eluent is changed	Instrument response within ± 25% of expected value using a standard at or below the MQL	Correct problem then repeat initial calibration	Apply R to all results for all samples associated with the calibration

Summary of Calibration and QC Procedures for Method 314.0

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
314.0 (cont.)	Perchlorate (cont.)	Continuing calibration verification	After every 10 samples and at the end of the analysis sequence	Instrument response within ± 15% of expected response, alternately using separate mid and high level standards	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Flagging conventions, Table 8.4
		Method blank	One per analytical batch	Perchlorate not detected >MQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.4
				Perchlorate detected, but <MQL	None; data qualification may be required	
		Pretreated laboratory reagent blank	Required in any analytical batch which includes samples that have been pretreated to reduce the common anion levels	Perchlorate not detected >MQL	Correct problem then reprep and analyze method blank and all samples processed with the contaminated blank	Flagging conventions, Table 8.4
				Perchlorate detected, but < MQL	None; data qualification my be required	
		LCS	One LCS per analytical batch	QC acceptance criteria Table 7.63	Correct problem then reanalyze the LCS; if the LCS is still out, reprepare and reanalyze the LCS and all samples in the affected AFCEE batch	Flagging conventions, Table 8.4
		MS/MSD	One MS/MSD per matrix per site; or as required by the project-specific FSP	QC acceptance criteria, Table 7.63	none	Flagging conventions, Table 8.4
		Demonstrate ability to generate acceptable accuracy and precision using four replicate analyzes of a QC check sample	Once per analyst	QC acceptance criteria, Table 7.63	Recalculate results; locate and fix problem with system and then rerun demonstration for those analytes that did not meet criteria	Apply R to all results for all samples analyzed by the analyst

Summary of Calibration and QC Procedures for Method 314.0

Method	Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action[a]	Flagging Criteria[b]
314.0 (cont.)	Perchlorate (cont.)	MCT determination	At initial set-up, once per 12 month period	Calculate $\%D_{A/H}$ for the perchlorate peak at increasing concentrations of mixed common anion solution The MCT is the matrix conductance where the $\%D_{A/H}$ exceeds 20%	option 1 -least squares regression: plot $\%D_{A/H}$ versus matrix conductance, ($r^2 > 0.95$) option 2 – Use the conductance level of the highest mixed anion solution which yielded a $\%D_{A/H}$ value < 20%	Samples cannot be analyzed without a valid MCT
		MQL verification	At initial set-up, once per 12 month period	Instrument response within ± 30% of expected response for a mixed common anion solution containing perchlorate at the RL and conductance within ± 10% of the MCT	Lower the MCT by 10% and repeat the MQL verification	Samples cannot be analyzed without a valid MQL verification
		MDL study	At initial set-up, once per 12 month period	Detection limits established will be < the MQLs in Table 7.62	none	Apply R to all results for in all samples analyzed
		Results reported between MDL and MQL	None	none	none	Apply F to all results between MDL and MQL

APPENDIX F

Contractor Forms

Work Plan Forms
ATF Form 5400.5, Report of Theft or Loss – Explosive Materials
Chemical Quality Control Report
Daily Operations Log
Daily Vehicle Inspection Form (for personnel & non-hazardous transport)
DD Form 1149, Requisition and Invoice / Shipping Document
DD Form 1348-1A, Issue Release / Receipt Document
DD Form 1662, DOD Property in the Custody of Contractors
Debris Inventory Log
Demolition Shot Log
Equipment Operational Check Log
Explosives Accountability Record (aka magazine data card)
Explosives Authorization Form
Explosives Consumption Certificate
Field Change Request Form
Government-Furnished Property (GFP) Tracking Log
Grid QC Summary Log
Grid Sweep Log
MEC Accountability Log
Non-Conformance Report
Quality Audit Checklist for UXO Sites
Quality Control Report
Quality Management System Checklist
Vehicle Inspection Form (for hazardous transport)

Field Sampling Plan Forms
Chemical Quality Control Report
Non-Conformance Report
Surface Soil Sampling Form

Site-Specific Health and Safety Plan Forms
Accident / Injury Investigation
ENG Form 3394, USACE Accident Investigation Report
Heat Stress Monitoring Log
Hepatitis B Vaccine Declination
Safety Inspection Checklist
Tailgate Safety Briefing / Training Form
Visitor Log
Wet Bulb Globe Temperature Log

Work Plan Forms

OMB No. 1512-0185 (09/30/2002)

DEPARTMENT OF THE TREASURY

BUREAU OF ALCOHOL, TOBACCO AND FIREARMS

REPORT OF THEFT OR LOSS-EXPLOSIVE MATERIALS

DATE

Upon discovery of any theft or loss of any of your explosive materials:

-First, contact ATF toll free at 1-800-461-8841 between 8:00 a.m. - 5:00 p.m. EST (or after-hours and weekends contact ATF collect at 1-888-283-2662) to report the theft or loss;
-Second, contact your local law enforcement office to report the theft or loss to obtain a police report; and
-Third, complete this form and attach any additional reports, sheets or invoices necessary to provide the required information, and fax then mail the form with additional material(s) to the nearest ATF office listed on the reverse. We suggest you retain a copy of the completed form. Please complete each item, as applicable, to the best of your ability.
NOTE: Section 842(k), 18 U.S.C., Chapter 40, states, "It shall be unlawful for any person who has knowledge of the theft or loss of any explosive materials from his stock to fail to report such theft or loss within twenty-four hours of discovery thereof to the Secretary and to appropriate local authorities." Codified at 27 C.F.R., Section 55.30.

1. NAME, ADDRESS AND TELEPHONE NUMBER OF PERSON MAKING REPORT *(Include corporate or business name, if applicable)*

2. LOCATION OF THEFT OR LOSS *(If different from item 1)*

3. THEFT OR LOSS	DATE	TIME
a. DISCOVERED		
b. OCCURRED *(Show approximate If exact not known)*		
c. REPORTED TO ATF BY TELEPHONE		
d. REPORTED TO LOCAL AUTHORITIES		

4. NAME AND ADDRESS OF LOCAL AUTHORITY TO WHOM REPORTED

POLICE REPORT NUMBER: ______________________

5. EXPLOSIVE MATERIALS LOST OR STOLEN *(Attach invoices or additional sheets, if necessary)*

a. MANUFACTURER OR BRAND NAME *(Include date and shift code)*	**b. QUANTITY** *(Pounds of Explosives, Number of Caps)*	**c. TYPE AND DESCRIPTION** *(Dynamite, Blasting Agents, Detonators, etc. Include for each type, size, MS delay or length of legwire, as applicable)*

6. THEFT OR LOSS OCCURRED FROM *(Check applicable box)*

☐ PERMANENT MAGAZINE ☐ PORTABLE MAGAZINE ☐ TRUCK ☐ WORK SITE ☐ OTHER *(Explain)* ______________

7. ENTRY TO MAGAZINE MADE THROUGH *(Complete if applicable)*

☐ DOOR ☐ ROOF ☐ FLOOR ☐ FOUNDATION

☐ WALL ☐ CEILING ☐ VENTS ☐ OTHER *(Explain)* ______________

8. NUMBER AND TYPE OF LOCKS FORCED *(Complete if applicable)*

9. OTHER INFORMATION PERTINENT OT THE THEFT OR LOSS

10. SIGNATURE AND TITLE OF PERSON MAKING REPORT

11. FEDERAL EXPLOSIVES LICENSE OR PERMIT, IF ANY

FOR ATF USE ONLY

DATE RECEIVED	TIME RECEIVED	UNIQUE IDENTIFIER

REPORTING INSTRUCTIONS

Forward or Fax this completed form to the ATF address listed below:

Bureau of Alcohol, Tobacco and Firearms
Arson and Explosives National Repository Branch (AENRB)
P.O. Box #50980
Washington, DC 20077-8001
Toll Free Fax: 1-866-927-4570

Questions regarding the completion of this form should be referred to the AENRB toll free at 1-800-461-8841.

PRIVACY ACT INFORMATION

The following information is provided pursuant to section 3 of the Privacy Act of 1974 (5 U.S.C. § 522a(e)(3).

1. **Authority.** Solicitation of this information is made pursuant to Title XI of the Organized Crime Control Act of 1970 (18 U.S.C. Chapter 40). Disclosure of a theft or loss of explosive materials is mandatory pursuant to 18 U.S.C. § 842(k) for any person who has knowledge of such theft or loss from his stock.

2. **Purpose.** The purpose for the collection of this information is to give ATF notice of the theft or loss of explosive materials, and to furnish ATF with the pertinent facts surrounding such theft or loss. In addition, the information is used to confirm and verify prior notification of this theft or loss of explosive materials.

3. **Routine Uses.** The information will be used by ATF to aid in the administration of laws within its jurisdiction concerning the regulation of explosive materials and other related areas. In addition, the information may be disclosed to other Federal, State, foreign, and local law enforcement of laws within their jurisdiction.

4. **Effects of not supplying information requested.** 18 U.S.C. § 842(k) makes it unlawful for any person, who has knowledge of the theft or loss of explosive materials from his stock, to fail to report such theft or loss within twenty-four hours of discovery thereof, to the Secretary and to appropriate local authorities. The penalty for violation of this section is a fine of not more than $1,000 or imprisonment for not more than one year, or both. 18 U.S.C. § 844(b).

PAPERWORK REDUCTION ACT NOTICE

This request in accordance with the Paperwork Reduction Act of 1995. The purpose of this information collection is to report the theft or loss of explosive materials. The information is used for investigative purposes by ATF officials. This information is mandatory by stature. (18 U.S.C. § 842)

The estimated average burden associated with this collection of information is 1 hour and 48 minutes per respondent or recordkeeper, depending on individual circumstances. Comments concerning the accuracy of this burden estimate and suggestions for reducing this burden should be addressed to Reports Management Officer, Document Services Branch, Bureau of Alcohol, Tobacco and Firearms, Washington, D. C. 20226.

An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number.

Chemical Quality Control Report

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

REPORT NUMBER	TIME ON SITE	PROJECT / LOCATION	
WEATHER		TEMPERATURE RANGE	WIND

SUMMARY OF SITE ACTIVITIES

LEVEL OF HEALTH & SAFETY PROTECTION

INSTRUMENTATION USED

CALIBRATION(S) PERFORMED

INSTRUMENT PROBLEMS / REMEDIES

SAMPLES COLLECTED

SAMPLE COLLECTION METHOD(S)

QUALITY CONTROL SAMPLES*

*Indicate **Sample Media** (groundwater, surface water, soil, or sediment), **Sample Type** (composite, grab, duplicate, rinsate), and **Sample ID Numbers**

ADDITIONAL REMARKS

SIGNATURE

Daily Operations Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page 1 of _______
Date: ____________
Day: ____________

Total Grids Cleared:	Total Excavations:
Total MEC:	Total Scrap (lbs):
Field Operation Time:	Gov't Delay Time:
Total number of Demo Shots Performed:	Weather Delay Time:
Weather:	Temp:

Grid I.D.	Vegetation Cleared (Acres)	Qty Live MEC	Number MEC Destroyed	MC Scrap Weight (lbs)	Total Digs	Non-MEC Scrap (lbs)	Hazardous Materials Located	QA/QC Completed

Activities Performed Today:

Daily Operations Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Date: ____________

Day: ____________

Comments (Use as many pages as necessary and include lessons learned where appropriate):

Planned Operations for Tomorrow:

SUXOS Signature:

Daily Vehicle Inspection Form

(Transport of Personnel and Non-Hazardous Equipment)

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

TYPE OF VEHICLE	LICENSE NUMBER	MAKE	MODEL
☐ Truck ☐ Jeep ☐ Car ☐ Tractor & Double Trailers ☐ Tractor & Closed Semi-Trailer ☐ Other ______________________________	RENTAL COMPANY		

ITEM NO.	CHECK APPROPRIATE COLUMN (See reverse side for explanatory notes)	CONDITION AT ORIGIN			REMARKS (Explain unsatisfactory item; use reverse side if necessary)
		SAT	UNSAT	NA	
1	ENGINE, BODY, CAB, & CHASSIS CLEAN				
2	STEERING MECHANISM				
3	HORN OPERATIVE				
4	WINDSHIELD & WIPERS				
5	REAR VIEW MIRRORS INSTALLED				
6	FULL FIRE EXTINGUISHER INSTALLED				
7	LIGHTS & REFLECTORS OPERATIVE				
8	EXHAUST SYSTEM				
9	FUEL TANK, LINE & INLET				
10	ALL BRAKES OPERATIVE				
11	SPRINGS & ASSOCIATED PARTS				
12	TIRES				
13	CARGO SPACE				
14	TAILGATE AND DOORS SECURED				
15	FIRST AID KIT				
16	ANY OTHER DEFECTS (specify)				

☐ APPROVED ☐ REJECTED	(If rejected give reason on reverse side. Equipment shall be approved if deficiencies are corrected prior to loading.)	UXOQC/SO SIGNATURE

REQUISITION AND INVOICE/SHIPPING DOCUMENT

Form Approved
OMB No.0704-0246
EXPIRES APR 30, 1989

Public reporting burden for this collection of information is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information. Including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for information Operation and Reports. 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction(074-0246), Washington, D.C. 20503.

1. FROM (Include Zip Code)	SHEET NO 1	NO OF SHEETS 1	5. REQUISITION DATE	6. REQUISITION NUMBER
	7. DATE MATERIAL REQUIRED			8. PRIORITY
2 TO- (Include ZIP Code)	9. AUTHORITY OR PURPOSE			
	10. SIGNATURE			11a. VOUCHER NUMBER & DATE (YYMMDD)
3. SHIP TO: MARK FOR	12. DATE SHIPPED (YYMMDD)			b.
	13. MODE OF SHIPMENT			14. BILL OF LADING NUMBER
	15. AIR MOVEMENT DESIGNATOR OR PORT OF REFERENCE NO			

4. APPROPRIATIONS SYMBOL AND SUBHEAD	OBJECT CLASS	EXPENDITURE ACCOUNT (From)	(To)	CHARGEABLE ACTIVITY	BUREAU CONTROL ACTIVITY NO.	BUREAU CONTROL NO	AMOUNT

ITEM NO (a)	FEDERAL STOCK NUMBER, DESCRIPTION, AND CODING OF MATERIAL AND/OR SERVICES	UNIT OF ISSUE (c)	QUANTITY REQUESTED (d)	SUPPLY ACTION (e)	TYPE CON TAINER (f)	CON-TAINER NOS (g)	UNIT PRICE (h)	TOTAL COST (i)

16. TRANSPORTATION VIA MATS OR MSTS CHARGEABLE TO

18 RECAPITULATION SHIPMENT		TOTAL CON-TAINER	TYPE CON-TAINER	DESCRIPTION	TOTAL WEIGHT	TOTAL CUBE
	ISSUED BY					
	CHECKED BY					
	PACKED BY					
				TOTAL		

19 RECEIPT		DATE (YYMMDD)	BY	
	CONTAINERS RECEIVED EXCEPT AS NOTED			SHEET TOTAL 0.00
	QUANTITIES RECEIVED EXCEPT AS NOTED	DATE(YYMMDD)	BY	GRAND TOTAL 0.00
	POSTED	DATE(YYMMDD	BY	20 RECEIVER'S VOUCHER NO

DD FORM 1348-1A, JUL 91 ISSUE RELEASE/RECEIPT DOCUMENT

PREVIOUS EDITION MAY BE USED

1	2	3	4	5	6	7		23	24	25	26	27	28	29		45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
DOC IDENT			RI FROM			M&S		UNIT	ISS	QUANTITY						SER	SUPPLEMENTARY ADDRESS					SIG	FUND		DISTRIBUTION			PROJECT			PRI		REQD DEL DATE			ADV		RI			O/P	COND	MGT		UNIT PRICE DOLLARS				CTS		

1. TOTAL PRICE

DOLLARS	CTS

2. SHIP FROM

3. SHIP TO

4. MARK FOR

5. DOC DATE	6. NMFC	7. FRT RATE	8. TYPE CARGO	9. PS

10. QTY. REC'D	11.UP	12. UNIT WEIGHT	13. UNIT CUBE	14. UFC	15. SL

16. FREIGHT CLASSIFICATION NOMENCLATURE

17. ITEM NOMENCLATURE

18. TY CONT	19. NO CONT	20. TOTAL WEIGHT	21. TOTAL CUBE

22. RECEIVED BY	23. DATE RECEIVED

24. DOCUMENT NUMBER & SUFFIX (30-44)

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6)
UI (23-24)
QTY (25-29)
CON CODE (71)
DIST (55-56)
UP (74-80)

27. ADDITIONAL DATA

Reset

DOD PROPERTY IN THE CUSTODY OF CONTRACTORS

(DFARS 245.505-14)

(See Instructions on back before completing this form.)

REPORT AS OF 30 SEP ______ OR ______

Form Approved
OMB No. 0704-0246
Expires Jan 31, 2003

PLEASE DO NOT RETURN YOUR COMPLETED FORM TO THIS ADDRESS.
RETURN COMPLETED FORM TO THE ADDRESS IN ITEM 1.

1. TO *(Enter name and address of property administrator)*	2. FROM *(Enter full name, address and CAGE code of contractor)*

3. IF GOVERNMENT-OWNED, CONTRACTOR-OPERATED PLANT, ENTER GOVERNMENT NAME OF PLANT

4. CONTRACT NO. *(PIIN)*	5. CONTRACT PURPOSE	6. BUSINESS TYPE *(Enter L, S, or N)*	7. OFFICIAL NAME OF PARENT COMPANY

8. PROPERTY LOCATION(S)	9. PLANT EQUIPMENT PACKAGE *(PEP No. and use)*

a. PROPERTY *(Type or Account)*	b. BALANCE START OF PERIOD		c. ADDITIONS *(in dollars)*	d. DELETIONS *(in dollars)*	e. BALANCE END OF PERIOD	
	(1) ACQUISITION COST *(in dollars)*	(2) QUANTITY *(in units or acres)*			(1) ACQUISITION COST *(in dollars)*	(2) QUANTITY *(in units or acres)*
10. LAND						
11. OTHER REAL PROPERTY						
12. OTHER PLANT EQUIPMENT						
13. INDUSTRIAL PLANT EQUIPMENT						
14. SPECIAL TEST EQUIPMENT						
15. SPECIAL TOOLING *(Government Title Only)*						
16. MILITARY PROPERTY *(Agency-Peculiar)*						
17. GOVERNMENT MATERIAL *(Government-Furnished)*						
18. GOVERNMENT MATERIAL *(Contractor-Acquired)*						

19. CONTRACTOR REPRESENTATIVE

a. TYPED NAME *(Last, First, Middle Initial)*	b. SIGNATURE	c. DATE SIGNED *(YYYYMMDD)*

20. DOD PROPERTY REPRESENTATIVE

a. TYPED NAME *(Last, First, Middle Initial)*	c. SIGNATURE	d. DATE SIGNED *(YYYYMMDD)*
b. TELEPHONE NUMBERS *(Commercial and DSN)*		

REPORTING INSTRUCTIONS

GENERAL. The prime contractor shall report all DoD property (as indicated) in its custody or in that of its subcontractors as of September 30 to the Government Property Representative by October 31 of each year. Also report zero end of period balances when no DoD property remains accountable to the contract. Report data from records maintained in accordance with FAR Subpart 45.5 and DFARS Subpart 245.5.

REPORT AS OF 30 SEP ______ . Fill in the appropriate year *(or other date).*

ITEM 1 - TO. Enter the name of the Government Property Representative, the Contract Administration Office or other office the Government Property Representative works for, and the full mailing address *(including City, State, and ZIP + 4).*

ITEM 2 - FROM. Enter the full name and address of the reporting contractor with the Division name stated after the Corporate name. Use the name as it appears on the contract but omit articles and insert spaces between company names that are made up of letters like XYZ Inc., for example. Also enter the Commercial and Government Entity (CAGE) Code.

ITEM 3 - IF GOVERNMENT-OWNED CONTRACTOR-OPERATED PLANT, ENTER GOVERNMENT NAME OF PLANT. Enter the Government name of the plant if the plant is Government-owned and Contractor-operated. Leave blank if it is a contractor-owned plant.

ITEM 4 - CONTRACT NO. (PIIN). Enter the 13-digit contract number or Procurement Instrument Identification Number (PIIN) under which the Government property is accountable. Use format XXXXXX-XX-X-XXXX.

ITEM 5 - CONTRACT PURPOSE. Enter one of the following 1-character alphabetic codes to identify the general purposes of the contract:

A. RDT&E

B. Supplies and Equipment *(deliverable end items)*

C. Facilities Contract

D. Lease of facilities by the contractor

E. Maintenance, Repair, Modification, or Rebuilding of Equipment

F. Operation of Government-Owned Plant or Facilities including test sites, ranges, installations

G. Service contract performed primarily on Military Installations, test facilities, ranges or sites

H. Contract for storage of Government Property

I. Others

ITEM 6 - BUSINESS TYPE. Enter a 1-character alphabetic code indicating the type of business concern:

L = Large   S = Small   N = Non-profit

(See FAR Part 19 for definition of Small Business and FAR 31.701 for definition of Non-profit Organizations.)

ITEM 7 - OFFICIAL NAME OF PARENT COMPANY. Enter the name of the Parent Corporation of the Reporting Contractor. The Parent Corporation is one in which common stock has been issued whether or not the stock is publicly traded and which is not a subsidiary of another corporation.

ITEM 8 - PROPERTY LOCATION(S). Enter the primary location(s) of the property if it is located at site(s) other than that of the Reporting Contractor, e.g., location of subcontract property or property at alternate sites of the prime contractor. Location is the City, State and Zip or the Military Installation or the Foreign site. Limit input to 69 characters. NOTE: Can be used as a "REMARKS" field.

ITEM 9 - PLANT EQUIPMENT PACKAGE. Enter the Number and Use of a Plant Equipment Package (PEP) if one exists on this contract. Leave blank otherwise. Example: ARMY PEP #570 - 81 mm Shells.

ITEMS 10 - 18.b.(1) - ACQUISITION COST (BALANCE AT THE BEGINNING OF THE FISCAL YEAR). Enter the acquisition cost for each type of property as defined in FAR 45.5 or DFARS 245.5. The amounts reported must agree with the amounts reported in the previous year for BALANCE AT END OF PERIOD.

ITEMS 10, 12 - 16.b.(2) - QUANTITY (BALANCE AT BEGINNING OF THE FISCAL YEAR). Enter the quantity for all categories of Government property except for Other Real Property and Material on hand at the beginning of the fiscal year. The amounts reported must agree with the amounts reported in the previous year for BALANCE AT END OF PERIOD.

ITEMS 10 - 15.c. - ADDITIONS *(in dollars).* For the property categories indicated, enter the acquisition cost for the total additions to the contract from any source during the fiscal year. Do not enter for Government Material or Military Property.

ITEMS 10 - 15.d. - DELETIONS *(in dollars).* For the property categories indicated, enter the acquisition cost for the total deletions from the contract during the fiscal year. Do not enter for Government Material or Military Property.

ITEMS 10 - 18.e.(1) - ACQUISITION COST (BALANCE AT THE END OF THE FISCAL YEAR). Enter the acquisition cost for each type of property as defined in FAR 45.5 or DFARS 245.5.

ITEMS 10, 12-16.e.(2) - QUANTITY (BALANCE AT END OF FISCAL YEAR). Enter the quantity for all categories of Government Property except for Other Real Property and Material on hand at the end of the fiscal year. These will be carried forward to reflect the balance at the beginning of the following year.

ITEMS 17 and 18 - GOVERNMENT MATERIAL. Report material as reflected on inventory records in accordance with FAR 45.505-3.

ITEM 19 - CONTRACTOR REPRESENTATIVE. Type the name of the contractor representative authorized by the property control system to sign this report.

ITEM 20 - DOD PROPERTY REPRESENTATIVE. Type the name of the DoD Property Administrator or other Authorized Property Representative, plus that individual's commercial area code and telephone number and DSN number *(if one exists).* Signature and date.

NOTE TO CONTRACTOR: When reporting more than one contract from the same location and the same contractor, you may elect to fill out Data Elements 1, 3, 6, 7, and 19 only once as long as each form can be readily identified if any form becomes separated from the others.

Debris Inventory Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______

UXO Tech II:	UXOQC/SO:
SUXOS:	Team Leader:

Date	Drum I.D.	Contents	Seal I.D.	UXO Tech II Initials	UXO Team Leader Initials	UXOQC/SO Initials	SUXOS Initials	Date Shipped

COMMENTS

Demolition Shot Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

GRID LOCATION: NORTHING	EASTING	TIME	SHOT NUMBER

WEATHER CONDITIONS:

CLOUD COVER %	HUMIDITY %	PRESSURE	TEMPERATURE °F	PRECIPITATION (inches)

PURPOSE OF SHOT

	MEC ITEM I.D.	DESCRIPTION	FINAL DISPOSITION
MUNITIONS DESTROYED (use extra sheet if necessary)			

TIME FUSE (feet)	FUSE LIGHTER (qty)	CAPS (qty)	DET CORD (feet)
PERFORATORS (qty)	SAFETY DISTANCE (ft)	TAMPING	NOISE READINGS

	QTY	DESCRIPTION
EXPLOSIVES		

	POINT OF CONTACT	AGENCY	PHONE NUMBER	CONTACTED? (Y/N)
NOTIFICATIONS				

COMMENTS

DEMO SUPERVISOR SIGNATURE	UXOQC/SO SIGNATURE

Equipment Operational Check Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Team #:	Team Leader:
Instrument Type: White's Metal Detector	Serial Number:

Date	Time	Maximum Allowable Height (ft)	Pass / Fail	Mode	Operator	# Found	# Placed	Remarks

Explosives Accountability Record

(Magazine Data Card)

Product Code / FSN:	Nomenclature:			Site Name: Address:
Date Code / Lot Number:	Hazard Class	UN or NA	Quantity / Case:	

Date	Bill of Lading / Voucher Number	Received From	Quantity Received	Quantity Issued	Issued To	Current Balance	Initials	
							Issuer	Receiver

Explosives Authorization Form

Address and County:____

____

Federal License #:____ Expiration Date:_____________

The following persons are agents, employees, or representatives of the undersigned, and are authorized to order or acquire explosive materials on behalf of EEG.

Name & Home Address	Driver's License No.	SSN	Place of Birth

The undersigned certifies that the foregoing information is true and correct to the best of his knowledge and belief, and that he will communicate any additions or deletions to the foregoing list to EEG.

______________________________ Corporate Officer	______________________________ Date

Explosives Consumption Certificate

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

Explosive Consumption Certificate		
Demolition Supervisor:		Site and Grid Number
Date	Issue Document Serial Number	Shot(s):

Item #	Manufacture	Nomenclature	Lot Number	Quantity Removed from Magazine	Quantity Consumed

Certifying Official		
I certify that I saw the above items consumed during demolition on		Date:
Team Member:	Position:	Signature:
SUXOS Name:		Signature:

Field Change Request Form

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Field Change No:______
Page ______ of ______
Date: ______________
Day: ______________

DESCRIPTION OF CHANGE:

Type of Change: ☐ Minor ☐ Major ☐ Major with Project Impact

REASON FOR CHANGE:

RECOMMENDED DISPOSITION:

PRESENT AND COMPLETED WORK IMPACT:

FINAL DISPOSITION:

Recorded By:____ Date:________________

Reviewed By:____ Date:________________
Quality Control Representative

Government-Furnished Property (GFP) Tracking Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
G&A Rate__________
Overhead Rate_____

Tracking I.D.	Date Purchased	Item	Vendor	Purchase Price	Tax	Loaded Cost	Total Cost	Condition

Ellis Environmental Group, LC

Grid QC Summary Log

UXOQC/SO: ______________________________

Grid ID: __________________________________

Insert
Magnetic
North
Direction

Team No.: _______________________________

Team Leader: ____________________________

Seed Item ID	Found By

Lane Designations	Equipment Operator

Grid Dimensions: Grid North __________ft. by East __________ ft.

ACTION	DATE	SIGNATURE	REMARKS
Seeded			
Surveyed			
Quality control complete			
Client quality assurance complete			

Ellis Environmental Group, LC

Grid Sweep Log

GRID ID: ____ Team No.: _________________________________

Date Started _____________ Date Completed _____________ Team Leader: ______________________________

Total Anomalies	Total Excavations	Buried Anomalies	Total MEC (quantity)	MD Scrap (pounds)	Non-MD Scrap (pounds)

MEC ID	NOMENCLATURE	FUZE	FILLER	DISPOSITION

ACTION	DATE	SIGNATURE
Vegetation removed		
Excavation complete		
Quality control complete		
Client quality assurance complete		

Vegetation type ____
____
Soil / rock type: ____
____
Ground slope (°): ____

Remarks:

Grid Sweep Log

Team No.: ______________________________

Team Leader: ____________________________

Grid Size N = _____________ ft. E = _____________ ft.

Grid ID ____________________ Date _______________

Insert Magnetic North Direction

UXO TECHNICIAN	LANES SURVEYED	LANES PASSED QC

Notes:

MEC Accountability Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______

UXO I.D. #	UXO Description	Fuze Condition	Filler	Depth (Feet)	Demo Date	Shot Number	Demolition Supervisor	Remarks

Non-Conformance Report

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

Non-Conformance Number: Status at Time of This Report:

Issued By: Date Opened: Date Closed:

PROBLEM DESCRIPTION & ROUTE CAUSE

CORRECTIVE ACTION		
NAME	DATE	CORRECTIVE ACTION

QUALITY ASSURANCE VERIFICATION			
VERIFIED BY	DATE	STATUS	NOTES

CLIENT NOTIFICATION SUMMARY		
PERSON(S) NOTIFIED	DATE	RESPONSE

APPROVAL HISTORY		
NAME	DATE	POSITION

Supplementary notes may be provided on attached pages.

Recorded By: ____ Date: _______________

Reviewed By: ____ Date: _______________

Quality Audit Checklist for UXO Sites

General Site Information

Site Name / Location: ______________________________

UXOQC/SO: ______________________________

Sr. UXO Supervisor: ______________________________

Project Manager: ______________________________

Audit Performed By: ______________________________ Date: ____________

UXO Operational Plan Compliance Items	In Compliance?		
	Yes	No	N/A
1.0 Approved Work Plan (WP)			
1.1 Approved WP available upon request to site, contractor, and regulatory personnel			
1.2 Management and site personnel familiar with WP			
1.3 Elements of WP being followed			
1.3.1 Phase I – Mobilization			
1.3.2 Phase II – Site Layout			
1.3.3 Phase III – Surface Ordnance and Explosives (OE) Survey			
1.3.4 Phase IV – UXO Geophysical Survey			
1.3.5 Phase V – Investigation/Removal Operations			
1.3.6 Phase VI – UXO Demolition			
2.0 Survey And Mapping Plan (SMP)			
2.1 Approved SMP available on site and personnel familiar with Plan			
2.2 Survey procedures being followed			
2.2.1 Survey monuments established			
2.2.2 Operating boundaries identified			
2.2.3 Grid delineation 200 x 200 feet			
2.2.4 Project map up to date			
2.2.5 Calibration of G-585 meets minimum manufacturer's recommendations			
2.2.6 Mapping procedures in accordance with (IAW) Plan			
2.2.7 Survey procedures IAW Plan			
2.2.8 Survey team composition IAW Plan			
2.3 Anomaly Marking Procedures			
2.3.1 Surveying procedures			
2.3.2 Flags and markers			

Quality Audit Checklist for UXO Sites

UXO Operational Plan Compliance Items	In Compliance?		
	Yes	No	N/A
3.0 Detection, Identification, Excavation, Removal, Storage and Disposal Plan			
3.1 Plan available on site and personnel familiar with Plan			
3.2 Excavation and removal conducted IAW Plan			
3.3 Demolition material storage IAW ATF Regulations			
3.4 Demolition equipment on hand and in functional order			
3.5 Blow-in-Place (BIP) Procedures			
3.5.1 Schedule posted and followed			
3.5.2 Coordination with local authorities			
3.5.3 Excavation and fragmentation distances IAW tables			
3.5.4 Priming and firing procedures followed as stated in Demolition SOP			
3.6 Accounting procedures in place and followed as stated in Demolition SOP			
3.7 Disposal methods for OE and scrap to include certification			
3.8 Inventory control procedures for UXO and demolition materials being used and inventory logs being maintained			
3.9 On-site storage meets ATF/USACE requirements			
3.10 Off-site storage meets ATF/USACE requirements			
3.11 Disposal safety precautions			
3.11.1 Warning devices on hand, functional, and used as required			
3.11.2 Primary and back-up communications			
3.11.3 Coordination with site personnel and local authorities			
3.12 Vehicle safety			
3.12.1 Vehicles in safe working order			
3.12.2 Vehicles inspected on routine basis			
3.12.3 Vehicles used for explosives/UXO transport meet DOT requirements			
4.0 Corporate Safety & Health Program and Site Safety & Health Plan			
4.0.1 Written Corporate Safety & Health Program (CSHP) available upon request to site, contractor, and regulatory personnel			
4.0.2 Relevant CSHP attachments, programs, and SOPs on site and being followed			
4.0.3 Work Plan (WP) and Site Safety & Health Plan (SSHP) on site, and SSHP Review Form signed by all site personnel			
4.0.4 Safety, training, visitor, and monitoring logs available and up to date			
4.1 Hazard Evaluation and Assessment			
4.1.1 Chemical hazards			
4.1.2 Physical hazards			

UXO Operational Plan Compliance Items		In Compliance?		
		Yes	No	N/A
4.1.3	UXO hazards			
4.1.4	Biological hazards			
4.2	Training Program			
4.2.1	All personnel OSHA 40-hr HAZWOPER certified (or equivalent), with annual refreshers as needed, and copies of all training certificates available on site			
4.2.2	Management and supervisory personnel have received additional 8-hour management and supervisor training			
4.2.3	Emergency response personnel have been designated and trained to handle anticipated emergencies			
4.24	Site Hazard Information Training presented which identifies the known or potential hazards associated with site operations, and employees informed of potential risks and hazards identified for each task they are to perform			
4.2.5	Employees notified of chemical, physical, and toxicological properties of identified or suspected on-site contaminants			
4.2.6	Hazard Communication Training given to personnel who work with products containing hazardous substances, to include a review of the relevant MSDSs			
4.2.7	Site personnel given OSHA-required, hazard-specific training, such as PPE, hearing conservation, etc., and training forms completed			
4.2.8	At least one site UXO technician trained in first aid/CPR			
4.2.9	Daily tailgate safety briefings and weekly safety meetings are being conducted and documented			
4.3	Medical Surveillance			
4.3.1	Medical surveillance available for personnel who receive a documented, unprotected overexposure or develop signs and symptoms of exposure			
4.3.2	Personnel with potential occupational exposure to blood or other infectious body fluids have been given the opportunity to be vaccinated against HBV, and personnel who decline have signed the HBV Vaccination Declaration Form			
4.4	Engineering Controls, Equipment, Work Practices and PPE			
4.4.1	Engineering controls and safe work practices (SWPs) being used whenever feasible; PPE used as final means to reduce personnel exposure			
4.4.2	Equipment required by the WP/SSHP is on site, inspected, and in proper working order			
4.4.3	PPE selected according to limitations of the PPE and the level/type of hazard			

UXO Operational Plan Compliance Items		In Compliance? Yes	No	N/A
4.5	Illumination			
4.5.1	No work being conducted on site until 30 minutes after sunrise or after 30 minutes before sunset, and adequate light levels maintained in all other work place facilities			
4.6	Sanitation			
4.6.1	Adequate supplies of potable water available from appropriately labeled containers/outlets			
4.6.2	Non-potable water sources appropriately labeled and no open or potential cross connection to potable sources exists			
4.6.3	Appropriate type and adequate number of toilets available			
4.6.4	Wash facilities located near site but away from exposure potentials			
4.6.5	Site being maintained in a neat and orderly fashion, free of trash and debris			
5.0	**Accident Prevention Plan**			
5.1	Emergency Response			
5.1.1	Written emergency response plan incorporated in APP			
5.1.2	Written procedures for reporting incidents to local, state, and federal agencies			
5.1.3	Emergency response plan reviewed, rehearsed regularly, and amended as needed			
5.1.4	Emergency phone numbers and hospital maps posted on site and placed in all vehicles			
5.1.5	First aid, burn and eye wash kits available on site and in each vehicle, with a bloodborne pathogen control kit located with each first aid kit			
5.1.6	Adequate type, number, size fire extinguishers appropriately located on site and inspected at least monthly, and flammable storage areas appropriately marked			
5.1.7	Employee alarm system on site and perceivable by site personnel			
6.0	**UXO/OE Records Management**			
6.1	SUXOS Log			
6.1.1	Is the log in the proper format and automated?			
6.1.2	Does the log contain necessary information IAW DID?			
6.2	QCS Log: Is the log being maintained properly?			
6.3	SSHO Log: Is the log being maintained properly?			
6.4	TL Log: Is the log being maintained properly?			
6.5	TL Daily’s: IAW DID and maintained properly?			
6.6	EODT grid maps and item logs used and maintained correctly?			
6.7	Grid/Ordnance Tracking Log maintained correctly?			

Quality Audit Checklist for UXO Sites

UXO Operational Plan Compliance Items	In Compliance? Yes	No	N/A
6.8 Can the QCS document weekly checks of the TL log books?			
6.9 Are the QCS and SSHO daily log sheets correct?			
6.10 Weekly Status Log			
6.10.1 Do the reports get delivered on time?			
6.10.2 Are all sheets updated with most current DID changes?			
6.10.3 Does the QCS do a final check before weekly sent?			
6.10.4 Are all copies maintained properly?			
6.11 Are photos being taken appropriate and suitable for final report?			
6.12 Does video cover necessary data and appropriate length?			
6.13 Does site have a book of ordnance items located on site?			

Remarks, Observations, and Recommendations

Signature of Auditor: ______________________ Date: __________

I acknowledge that I have been briefed on the results of this audit and will take any necessary corrective actions.

Signature of SUXOS: ______________________ Date: __________

Signature of UXOQC/SO: ______________________ Date: __________

Signature of Site Manager: ______________________ Date: __________

Quality Control Report

Non-Time-Critical Removal Action at Municipality of Culebra, PR

US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page 1 of _______
Date: ____________
Day: _____________
Report Number _____

EQUIPMENT USED TODAY

Item	Quantity	Supplier	Total Hours	Down Time	Mileage

ON-SITE PERSONNEL HOURS TODAY

Employee	Company	Position	Hours

STATUS SUMMARY

Category	Report Total	Total to Date
Total man hours		
Total vehicle miles		
Lost workday accidents		
Grids completed		
Man hours lost due to weather		
Man hours lost due to govt. delays		

ACTIVITIES IN PROGRESS

Status	Activities	Task Number	Team ID	Hours

Status Column (S = Start, C = Continue, F = Finish)

Quality Control Report

Date ___________

DISCUSSIONS

Remarks	Action	Phone Number

Has anything developed which might lead to a change order? ☐ Yes ☐ No If yes, attach Change Order Request

SAFETY OR QC ISSUES / ACCIDENTS

Description	Action Taken	Results	Personnel	Notes

Were any lost time accidents today? ☐ Yes ☐ No If yes, attach Accident Report Form

WEATHER SUMMARY

Time	Conditions	Temperature	Humidity	Precipitation	Wind	Cloud Cover

Were there any weather delays today? ☐ Yes ☐ No Cumulative time lost (to date) due to weather: _______ hours

QA/QC RESULTS

Grid ID	QC Results	Notes	Grid ID	QA Results	Notes

Miscellaneous Notes

Tomorrow's Schedule ( ):

Signature and Certification

I certify that this report is complete and correct to the best of my knowledge. All equipment and material used and work performed during this reporting period are in compliance with the contract plans and specifications except as noted.

Signature: ____ Date: ____________________

Quality Management System Checklist

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

SUXOS:	SM:
TEAM:	UXOQC/SO:

SENSOR(S) TYPE USED	SERIAL (INVENTORY) NUMBER	SENSOR SETTINGS USED

AREA / ITEM QC'd	TEAM	SATISFACTORY	UNSATISFACTORY
Proper work attire (PPE)			
Equipment operation checks			
Vehicle condition			
Brush cutting equipment conditions			
Emergency equipment, first aid kit, burn kit, fire extinguisher			
Proper grid layout			
Proper search techniques			
Proper use of grubbing equipment			
Proper tamping and demo shot techniques			
Team leaders daily paper work			
Office paper work			
Mapping and UXO data			
Field office operation			
Daily scrap certification and concurrence			

QA TEST

Technician	Sweep Height (Pass/Fail)	Equipment Operation (Pass/Fail)	Sweep Width (Pass/Fail)	Lanes Swept (Lane ID)	QC Seeding Items Found (Count)	(Pass/Fail)	Comments

QCS SIGNATURE:

Vehicle Inspection Form

(Transport of Hazardous Material)

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

GBL NO.	ORIGIN	DESTINATION
NAME OF CARRIER		
NAME OF DRIVER		
DATE AND HOUR		
INSTALLATION/ACTIVITY		
DRIVER'S STATE PERMIT NO.		
MEDICAL EXAMINER'S CERTIFICATE & DATE		

VEHICLE

TYPE OF VEHICLE	TRUCK NUMBER	TRAILER(S) NUMBER	SLEEPER CAB? ☐ YES ☐ NO
☐ Truck ☐ Truck & Full Trailer ☐ Tractor & Double Trailers	ORIGIN	ORIGIN	VALID LEASE? ☐ YES ☐ NO
☐ Tractor & Closed Semi-Trailer ☐ Tractor & Flatbed Trailer	DESTINATION	DESTINATION	I.C.C. NUMBER

NOTE: All of the following items shall be checked on empty equipment prior to loading.
Items with an asterisk (*) shall be checked on incoming loaded equipment.

ITEM NO.	CHECK APPROPRIATE COLUMN (See reverse side for explanatory notes)	ORIGIN		DESTINATION		REMARKS (Explain unsatisfactory Item; use reverse side if necessary)
		SAT	UNSAT	SAT	UNSAT	
1	ENGINE, BODY, CAB, & CHASSIS CLEAN					
2	STEERING MECHANISM					
3	HORN OPERATIVE					
4	WINDSHIELD & WIPERS					
5	SPARE ELECTRIC FUSES AVAILABLE					
6	REAR VIEW MIRRORS INSTALLED					
7	HIGHWAY WARNING EQUIPMENT					
*8	FULL FIRE EXTINGUISHER INSTALLED					
9	LIGHTS & REFLECTORS OPERATIVE					
10	EXHAUST SYSTEM					
*11	FUEL TANK, LINE & INLET					
*12	ALL BRAKES OPERATIVE					
13	SPRINGS & ASSOCIATED PARTS					
*14	TIRES					
15	CARGO SPACE					
*16	ELECTRIC WIRING					
*17	TAILGATE AND DOORS SECURED					
18	ANY OTHER DEFECTS (Specify)					

☐ APPROVED ☐ REJECTED	(If rejected give reason on reverse side. Equipment shall be approved if deficiencies are corrected prior to loading.)	SIGNATURE (of inspector) ORIGIN	SIGNATURE (of inspector) DESTINATION

	ITEMS TO BE CHECKED PRIOR TO RELEASE OF LOADED VEHICLE	ORIGIN	DESTINATION
19	MIXTURES OF MATERIAL PROHIBITED BY DOT REGS. ARE NOT LOADED ONTO THIS VEHICLE		
*20	LOAD IS SECURED TO PREVENT MOVEMENT		
21	WEIGHT IS PROPERLY DISTRIBUTED & VEHICLE IS NOT OVERWEIGHT		
*22	SPECIAL INSTRUCTIONS (DD Form 836) FURNISHED DRIVER		
*23	COPY OF VEHICLE INSPECTION (DD Form 626) FURNISHED DRIVER		
*24	PROPER PLACARDS APPLIED		
*25	SHIPMENT MADE UNDER DOT EXCEPTION 868		

SIGNATURE (of Inspector) ORIGIN	SIGNATURE (of Driver) ORIGIN
SIGNATURE (of Inspector) DESTINATION	SIGNATURE (of Driver) DESTINATION

Field Sampling Plan Forms

Chemical Quality Control Report

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

REPORT NUMBER	TIME ON SITE	PROJECT / LOCATION	
WEATHER		TEMPERATURE RANGE	WIND
SUMMARY OF SITE ACTIVITIES			
LEVEL OF HEALTH & SAFETY PROTECTION			
INSTRUMENTATION USED			
	CALIBRATION(S) PERFORMED		
	INSTRUMENT PROBLEMS / REMEDIES		
SAMPLES COLLECTED			
SAMPLE COLLECTION METHOD(S)			
QUALITY CONTROL SAMPLES* *Indicate **Sample Media** (groundwater, surface water, soil, or sediment), **Sample Type** (composite, grab, duplicate, rinsate), and **Sample ID Numbers**			
ADDITIONAL REMARKS			
SIGNATURE			

Ellis
Environmental
Group, LC

Non-Conformance Report

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

Non Conformance Number:	Status at time of this Report:	
Date Opened:	Issued By:	Date Closed:

Problem Description and Route Cause		
Name	Date	Description

Corrective Action		
Name	Date	Corrective Action

Quality Assurance Verification			
Verified By	Date	Status	Notes

Client Notification Summary		
Person(s) Notified	Date	Response

Approval History		
Name	Date	Position

Supplementary notes may be provided on attached pages

Recorded By:	Date:
Reviewed By:	Date:

Ellis Environmental Group, LC

Surface Soil Sampling Form

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

Sample Information:	
Time	Sample Depth
Depth	Sample Number

Field Parameters:

____ ____
____ ____
____ ____
____ ____

Fractions Collected:

Weather Conditions (Prior 3 Days):

General Observations:

Recorded By:____ Date:____________________________

Site-Specific Health and Safety Plan Forms

Accident / Injury Investigation

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

MUST BE COMPLETED WITHIN 72 HOURS	Date of Accident/Injury:
Employee Name:	Supervisor Name:

Description (Provide facts, describe how incident occurred, provide diagram or photos)

Analysis 1 (What unsafe acts or conditions contributed to the incident)

Analysis 2 (What systematic or management deficiencies contributed to the incident?)

Corrective Action(s) (List corrective actions, responsible person, scheduled completion date)

Witnesses (Attach statements or indicate why not available)

	Print Name	Signature	Date
Investigated by			
SUXOS			

(For Safety Staff only)	REPORT NO.	EROC CODE	UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT (For Use of this Form See Help Menu and USACE Suppl to AR 385-40)	REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)

1. ACCIDENT CLASSIFICATION

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

2. PERSONAL DATA

a. Name *(Last, First, MI)* | b. AGE | c. SEX ☐ MALE ☐ FEMALE | d. SOCIAL SECURITY NUMBER | e. GRADE

f. JOB SERIES/TITLE

g. DUTY STATUS AT TIME OF ACCIDENT: ☐ ON DUTY ☐ TDY ☐ OFF DUTY

h. EMPLOYMENT STATUS AT TIME OF ACCIDENT: ☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)* ____

3. GENERAL INFORMATION

a. DATE OF ACCIDENT *(month/day/year)* | b. TIME OF ACCIDENT *(Military time)* hrs | c. EXACT LOCATION OF ACCIDENT | d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:

e. CONTRACT NUMBER ____ ☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)* ____

f. TYPE OF CONTRACT: ☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)* ____

g. HAZARDOUS/TOXIC WASTE ACTIVITY: ☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)* ____

4. CONSTRUCTION ACTIVITIES ONLY *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY ____ (CODE) #

b. TYPE OF CONSTRUCTION EQUIPMENT ____ (CODE) #

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see help menu)*

a. SEVERITY OF ILLNESS/INJURY ____ (CODE) # | B. ESTIMATED DAYS LOST | C. ESTIMATED DAYS HOSPIT-ALIZED | D. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED: PRIMARY ____ (CODE) #; SECONDARY ____ (CODE) #

f. NATURE OF ILLNESS / INJURY ____ (CODE) #

g. TYPE AND SOURCE OF INJURY/ILLNESS: TYPE ____ (CODE) #; SOURCE ____ (CODE) #

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT ____ (CODE) #

b. PERSONAL FLOATATION DEVICE USED? ☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE: ☐ PICKUP/VAN ☐ AUTOMOBILE ☐ TRUCK ☐ OTHER *(Specify)* ____

b. TYPE OF COLLISION: ☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END ☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER *(Specify)* ____

c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
(1) FRONT SEAT			
(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	B. OWNERSHIP	C. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. TYPE OF VESSEl/FLOATING PLANT ____ (CODE) #

b. TYPE OF COLLISION/MISHAP ____ (CODE) #

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

See attached page.

11. CAUSAL FACTOR(S) *(Read Instruction Before Completing)*					
a. (Explain YES answers in item 13)	YES	NO	a. *(CONTINUED)*	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐	CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐	OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐	SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐	PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐	DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐	b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?		
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐	☐ YES *(If yes, attach a copy.)* ☐ NO		

12. TRAINING		
a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING.	c. DATE OF MOST RECENT FORMAL TRAINING.
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	(Month) (Day) (Year)

13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

See attached page.

b. INDIRECT CAUSE(S)

See attached page.

14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).

DESCRIBE FULLY:

See attached page.

15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.			
a. BEGINNING (Month/Day/Year)		b. ANTICIPATED COMPLETION (Month/Day/Year)	
c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT CORPS ______ CONTRACTOR ______	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL

16. MANAGEMENT REVIEW *(1st)*		
a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS		
SIGNATURE	TITLE	DATE

17. MANAGEMENT REVIEW *(2nd - Chief Operations, Construction, Engineering, etc.)*		
a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS		
SIGNATURE	TITLE	DATE

18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW		
a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS		
SIGNATURE	TITLE	DATE

19. COMMAND APPROVAL	
COMMENTS	
COMMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE: 1993-0-791-757

10. **ACCIDENT DESCRIPTION** *(Continuation)*

13a. **DIRECT CAUSE** *(Continuation)*

13b. **INDIRECT CAUSES** *(Continuation)*

14. **ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S)** *(Continuation)*

GENERAL. Complete a separate report for each person who was *injured, caused,* or *contributed* to the accident (excluding uninjured personnel and witnesses). Use of this form for reporting USACE employee first-aid type injuries not submitted to the Office of Workers' Compensation Programs (OWCP) shall be at the descretion of the FOA commander. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16. and 17.

INSTRUCTIONS FOR SECTION 1 — ACCIDENT CLASSIFICATION. *(Mark All Boxes That Are Applicable.)*

a. GOVERNMENT. Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.

(1) INJURY/ILLNESS/FATALITY — Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of OWCP Forms CA-1 (injury), CA-2 (illness), or CA-6 (fatality) to OWCP; mark if accident resulted in military personnel lost-time or fatal injury or illness.

(2) PROPERTY DAMAGE — Mark the appropriate box if accident resulted in any damage of $1000 or more to government property (including motor vehicles).

(3) VEHICLE INVOLVED — Mark if accident involved a motor vehicle, *regardless* of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY — Mark if the accident involved an in-house USACE diving activity.

b. CONTRACTOR.

(1) INJURY/ILLNESS/FATALITY — Mark if accident resulted in any contractor lost-time injury/illness or fatality.

(2) PROPERTY DAMAGE — Mark the appropriate box if accident resulted in any damage of $1000 or more to contractor property (including motor vehicles).

(3) VEHICLE INVOLVED — Mark if accident involved a motor vehicle, *regardless* of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY — Mark if the accident involved a USACE Contractor diving activity.

c. PUBLIC.

(1) INJURY/ILLNESS/FATALITY — Mark if accident resulted in public fatality or permanent total disability. (The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander).

(2) VOID SPACE — Make no entry.

(3) VEHICLE INVOLVED — Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, *regardless* of whether "INJURY/ILLNESS/FATALITY" is marked.

(4) VOID SPACE — Make no entry.

INSTRUCTIONS FOR SECTION 2 — PERSONAL DATA

a. NAME — (MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS). Enter last name, first name, middle initial of person involved.

b. AGE — Enter age.

c. SEX — Mark appropriate box.

d. SOCIAL SECURITY NUMBER — (FOR GOVERNMENT PERSONNEL ONLY) Enter the social security number (or other personal identification number if no social security number issued).

e. GRADE — (FOR GOVERNMENT PERSONNEL ONLY) Enter pay grade. Example: O-6; E-7; WG-8; WS-12; GS-11; etc.

f. JOB SERIES/TITLE — For *government civilian employees* enter the pay plan, full series number, and job title, e.g. GS-0810/Civil Engineer. For *military personnel* enter the primary military occupational specialty (PMOS), e.g., 15A30 or 11G50. For *contractor employees* enter the job title assigned to the injured person, e.g. carpenter, laborer, surveyor, etc.,

g. DUTY STATUS — Mark the appropriate box.

(1) ON DUTY — Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.

(2) TDY - Person was on official business, away from the duty station and with travel orders at time of accident. Line-of-duty investigation required.

(3) OFF DUTY - Person was not on official business at time of accident

h. EMPLOYMENT STATUS — (FOR GOVERNMENT PERSONNEL ONLY) Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTION FOR SECTION 3 — GENERAL INFORMATION

a. DATE OF ACCIDENT — Enter the month, day, and year of accident.

b. TIME OF ACCIDENT — Enter the local time of accident in military time. Example: 1430 hrs (not 2:30 p.m.).

c. EXACT LOCATION OF ACCIDENT — Enter facts needed to locate the accident scene. (installation/project name, building number, street, direction and distance from closest landmark, etc.,).

d. CONTRACTOR NAME

(1) PRIME — Enter the exact name (title of firm) of the prime contractor.

(2) SUBCONTRACTOR — Enter the name of any subcontractor involved in the accident.

e. CONTRACT NUMBER — Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.

f. TYPE OF CONTRACT — Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.

g. HAZARDOUS/TOXIC WASTE ACTIVITY (HTW) — Mark the box to identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration Program (IRP) HTW activities include accidents that occurred during inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site (FUDS) activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4 — CONSTRUCTION ACTIVITIES

a. CONSTRUCTION ACTIVITY — Select the *most appropriate* construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

1. MOBILIZATION	14. ELECTRICAL
2. SITE PREPARATION	15. SCAFFOLDING/ACCESS
3. EXCAVATION/TRENCHING	16. MECHANICAL
4. GRADING (EARTHWORK)	17. PAINTING
5. PIPING/UTILITIES	18. EQUIPMENT/MAINTENANCE
6. FOUNDATION	19. TUNNELING
7. FORMING	20. WAREHOUSING/STORAGE
8. CONCRETE PLACEMENT	21. PAVING
9. STEEL ERECTION	22. FENCING
10. ROOFING	23. SIGNING
11. FRAMING	24. LANDSCAPING/IRRIGATION
12. MASONRY	25. INSULATION
13. CARPENTRY	26. DEMOLITION

b. TYPE OF CONSTRUCTION EQUIPMENT — Select the equipment involved in the accident from the list below. Enter the name and place the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER", and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

1. GRADER
2. DRAGLINE
3. CRANE (ON VESSEL/BARGE)
4. CRANE (TRACKED)
5. CRANE (RUBBER TIRE)
6. CRANE (VEHICLE MOUNTED)
7. CRANE (TOWER)
8. SHOVEL
9. SCRAPER
10. PUMP TRUCK (CONCRETE)
11. TRUCK (CONCRETE/TRANSIT MIXER)
12. DUMP TRUCK (HIGHWAY)
13. DUMP TRUCK (OFF HIGHWAY)
14. TRUCK (OTHER)
15. FORKLIFT
16. BACKHOE
17. FRONT-END LOADER
18. PILE DRIVER
19. TRACTOR (UTILITY)
20. MANLIFT
21. DOZER
22. DRILL RIG
23. COMPACTOR/VIBRATORY ROLLER
24. OTHER

INSTRUCTIONS FOR SECTION 5 — INJURY/ILLNESS INFORMATION

a. SEVERITY OF INJURY / ILLNESS - Reference para 2-10 of USACE Suppl 1 to AR 385-40 and enter code and description from list below.

NOI NO INJURY
FAT FATALITY
PTL PERMANENT TOTAL DISABILITY
PPR PERMANENT PARTIAL DISABILITY
LWD LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK
NLW RECORDABLE CASE WITHOUT LOST WORKDAYS
RFA RECORDABLE FIRST AID CASE
NRI NON-RECORDABLE INJURY

b. ESTIMATED DAYS LOST — Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED — Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY — Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED — Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME
ARM/WRIST	AB	ARM AND WRIST
	AS	ARM OR WRIST
TRUNK, EXTERNAL MUSCULATURE	B1	SINGLE BREAST
	B2	BOTH BREASTS
	B3	SINGLE TESTICLE
	B4	BOTH TESTICLES
	BA	ABDOMEN
	BC	CHEST
	BL	LOWER BACK
	BP	PENIS
	BS	SIDE
	BU	UPPER BACK
	BW	WAIST
	BZ	TRUNK OTHER
HEAD, INTERNAL	C1	SINGLE EAR INTERNAL
	C2	BOTH EARS INTERNAL
	C3	SINGLE EYE INTERNAL
	C4	BOTH EYES INTERNAL
	CB	BRAIN
	CC	CRANIAL BONES
	CD	TEETH
	CJ	JAW
	CL	THROAT, LARYNX
	CM	MOUTH
	CN	NOSE
	CR	THROAT, OTHER
	CT	TONGUE
	CZ	HEAD OTHER INTERNAL
ELBOW	EB	BOTH ELBOWS
	ES	SINGLE ELBOW
FINGER	F1	FIRST FINGER
	F2	BOTH FIRST FINGERS
	F3	SECOND FINGER
	F4	BOTH SECOND FINGERS
	F5	THIRD FINGER
	F6	BOTH THIRD FINGERS
	F7	FOURTH FINGER
	F8	BOTH FOURTH FINGERS
TOE	G1	GREAT TOE
	G2	BOTH GREAT TOES
	G3	TOE OTHER
	G4	TOES OTHER
HEAD, EXTERNAL	H1	EYE EXTERNAL
	H2	BOTH EYES EXTERNAL
	H3	EAR EXTERNAL
	H4	BOTH EARS EXTERNAL
	HC	CHIN
	HF	FACE
	HK	NECK/THROAT
	HM	MOUTH/LIPS
	HN	NOSE
	HS	SCALP
KNEE	KB	BOTH KNEES
	KS	KNEE
LEG, HIP, ANKLE, BUTTOCK	LB	BOTH LEGS/HIPS/ ANKLES/BUTTOCKS
	LS	SINGLE LEG/HIP ANKLE/BUTTOCK
HAND	MB	BOTH HANDS
	MS	SINGLE HAND
FOOT	PB	BOTH FEET
	PS	SINGLE FOOT
TRUNK, BONES	R1	SINGLE COLLAR BONE
	R2	BOTH COLLAR BONES
	R3	SHOULDER BLADE
	R4	BOTH SHOULDER BLADES
	RB	RIB
	RS	STERNUM (BREAST BONE)
	RV	VERTEBRAE (SPINE; DISC)
	RZ	TRUNK BONES OTHER
SHOULDER	SB	BOTH SHOULDERS
	SS	SINGLE SHOULDER
THUMB	TB	BOTH THUMBS
	TS	SINGLE THUMB
TRUNK, INTERNAL ORGANS	V1	LUNG, SINGLE
	V2	LUNGS, BOTH
	V3	KIDNEY, SINGLE
	V4	KIDNEYS, BOTH
	VH	HEART
	VL	LIVER
	VR	REPRODUCTIVE ORGANS
	VS	STOMACH
	VV	INTESTINES
	VZ	TRUNK, INTERNAL; OTHER

f. NATURE OF INJURY/ILLNESS - Select the most appropriate nature of injury / illness from the list below. This nature of injury / illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury / illness name on the line and place the corresponding CODE letters in the box provided.

* The injury or condition selected below must be caused by a specific incident or event which occurred during a single work day or shift.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
*TRAUMATIC INJURY OR DISABILITY	TA	AMPUTATION
	TB	BACK STRAIN
	TC	CONTUSION; BRUISE: ABRASION
	TD	DISLOCATION
	TF	FRACTURE
	TH	HERNIA
	TK	CONCUSSION
	TL	LACERATION, CUT
	TP	PUNCTURE
	TS	STRAIN, MULTIPLE
	TU	BURN, SCALD, SUNBURN
	TI	TRAUMATIC SKIN DISEASES/ CONDITIONS INCLUDING DERMATITIS
	TR	TRAUMATIC RESPIRATORY DISEASE
	TQ	TRAUMATIC FOOD POISONING
	TW	TRAUMATIC TUBERCULOSIS
	TX	TRAUMATIC VIROLOGICAL/ INFECTIVE/PARASITIC DISEASE
	T1	TRAUMATIC CEREBRAL VASCULAR CONDITION/STROKE
	T2	TRAUMATIC HEARING LOSS
	T3	TRAUMATIC HEART CONDITION
	T4	TRAUMATIC MENTAL DISORDER; STRESS; NERVOUS CONDITION
	T8	TRAUMATIC INJURY — OTHER (EXCEPT DISEASE, ILLNESS)

**A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and repeated exposures to conditions of the work environment over a long period of time. For practical purposes, an occupational illness/disease or disability is any reported condition which doses not meet the definition of traumatic injury or disability as described above.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
**NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY		
RESPIRATORY DISEASE	RA	ASBESTOSIS
	RB	BRONCHITIS
	RE	EMPHYSEMA
	RP	PNEUMOCONIOSIS
	RS	SILICOSIS
	R9	RESPIRATORY DISEASE, OTHER
VIROLOGICAL, INFECTIVE & PARASITIC DISEASES	VB	BRUCELLOSIS
	VC	COCCIDIOMYCOSIS
	VF	FOOD POISONING
	VH	HEPATITIS
	VM	MALARIA
	VS	STAPHYLOCOCCUS
	VT	TUBERCULOSIS
	V9	VIROLOGICAL/INFECTIVE/ PARASITIC—OTHER
DISABILITY, OCCUPATIONAL	DA	ARTHRITIS, BURSITIS
	DB	BACK STRAIN, BACK SPRAIN
	DC	CEREBRAL VASCULAR CONDITION; STROKE
	DD	ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)
	DE	EFFECT OF ENVIRONMENTAL CONDITION
	DH	HEARING LOSS
	DK	HEART CONDITION
	DM	MENTAL DISORDER, EMOTIONAL STRESS NERVOUS CONDITION
	DR	RADIATION
	DS	STRAIN, MULTIPLE
	DU	ULCER
	DV	OTHER VASCULAR CONDITIONS
	D9	DISABILITY, OTHER
SKIN DISEASE OR CONDITION	SB	BIOLOGICAL
	SC	CHEMICAL
	S9	DERMATITIS, UNCLASSIFIED

g. TYPE AND SOURCE OF INJURY/ILLNESS (CAUSE) - Type and Source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident (see example 1, below). Examples:

(1) An employee tripped on carpet and struck his head on a desk.
TYPE: 210 (fell on same level) SOURCE: 0110 (walking/working surface)

NOTE: This example would NOT be coded 120 (struck against) and 0140 (furniture).

(2) A Park Ranger contracted dermatitis from contact with poison ivy/ oak.
TYPE: 510 (contact) SOURCE: 0920 (plant)

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade.
TYPE: 410 (punctured by) SOURCE: 0830 (metal)

(4) An employee was driving a government vehicle when it was struck by another vehicle..
TYPE: 800 (traveling in) SOURCE: 0421 (government-owned vehicle, as driver)

NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	TYPE OF INJURY NAME
	STRUCK
0110	STRUCK BY
0111	STRUCK BY FALLING OBJECT
0120	STRUCK AGAINST
	FELL, SLIPPED, TRIPPED
0210	FELL ON SAME LEVEL
0220	FELL ON DIFFERENT LEVEL
0230	SLIPPED, TRIPPED (NO FALL)
	CAUGHT
0310	CAUGHT ON
0320	CAUGHT IN
0330	CAUGHT BETWEEN
	PUNCTURED, LACERATED
0410	PUNCTURED BY
0420	CUT BY
0430	STUNG BY
0440	BITTEN BY
	CONTACTED
0510	CONTACTED WITH (INJURED PERSON MOVING)
0520	CONTACTED BY (OBJECT WAS MOVING)
	EXERTED
0610	LIFTED, STRAINED BY (SINGLE ACTION)
0620	STRESSED BY (REPEATED ACTION)
	EXPOSED
0710	INHALED
0720	INGESTED
0730	ABSORBED
0740	EXPOSED TO
0800	TRAVELING IN

CODE	SOURCE OF INJURY NAME
0100	BUILDING OR WORKING AREA
0110	WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC)
0120	STAIRS, STEPS
0130	LADDER
0140	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0150	BOILER, PRESSURE VESSEL
0160	EQUIPMENT LAYOUT (ERGONOMIC)
0170	WINDOWS, DOORS
0180	ELECTRICITY

CODE	SOURCE OF INJURY NAME
0200	ENVIRONMENTAL CONDITION
0210	TEMPERATURE EXTREME (INDOOR)
0220	WEATHER (ICE, RAIN, HEAT, ETC.)
0230	FIRE, FLAME, SMOKE (NOT TOBACCO)
0240	NOISE
0250	RADIATION
0260	LIGHT
0270	VENTILATION
0271	TOBACCO SMOKE
0280	STRESS (EMOTIONAL)
0290	CONFINED SPACE
0300	MACHINE OR TOOL
0310	HAND TOOL (POWERED: SAW, GRINDER, ETC.)
0320	HAND TOOL (NONPOWERED)
0330	MECHANICAL POWER TRANSMISSION APPARATUS
0340	GUARD, SHIELD (FIXED, MOVEABLE, INTERLOCK)
0350	VIDEO DISPLAY TERMINAL
0360	PUMP, COMPRESSOR, AIR PRESSURE TOOL
0370	HEATING EQUIPMENT
0380	WELDING EQUIPMENT
0400	VEHICLE
0411	AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE
0412	AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE
0421	DRIVER OF GOVERNMENT VEHICLE
0422	PASSENGER OF GOVERNMENT VEHICLE
0430	COMMON CARRIER (AIRLINE, BUS, ETC.)
0440	AIRCRAFT (NOT COMMERCIAL)
0450	BOAT, SHIP, BARGE
0500	MATERIAL HANDLING EQUIPMENT
0510	EARTHMOVER (TRACTOR, BACKHOE, ETC.)
0520	CONVEYOR (FOR MATERIAL AND EQUIPMENT)
0530	ELEVATOR, ESCALATOR, PERSONNEL HOIST
0540	HOIST, SLING CHAIN, JACK
0550	CRANE
0551	FORKLIFT
0560	HANDTRUCK, DOLLY
0600	DUST, VAPOR, ETC.
0610	DUST (SILICA, COAL, ETC.)
0620	FIBERS
0621	ASBESTOS
0630	GASES
0631	CARBON MONOXIDE
0640	MIST, STEAM, VAPOR, FUME
0641	WELDING FUMES
0650	PARTICLES (UNIDENTIFIED)
0700	CHEMICAL, PLASTIC, ETC.
0711	DRY CHEMICAL—CORROSIVE
0712	DRY CHEMICAL—TOXIC
0713	DRY CHEMICAL—EXPLOSIVE
0714	DRY CHEMICAL—FLAMMABLE
0721	LIQUID CHEMICAL—CORROSIVE
0722	LIQUID CHEMICAL—TOXIC
0723	LIQUID CHEMICAL—EXPLOSIVE
0724	LIQUID CHEMICAL—FLAMMABLE
0730	PLASTIC
0740	WATER
0750	MEDICINE
0800	INANIMATE OBJECT
0810	BOX, BARREL, ETC.
0820	PAPER
0830	METAL ITEM, MINERAL
0831	NEEDLE
0840	GLASS
0850	SCRAP, TRASH
0860	WOOD
0870	FOOD
0880	CLOTHING, APPAREL, SHOES
0900	ANIMATE OBJECT
0911	DOG
0912	OTHER ANIMAL
0920	PLANT
0930	INSECT
0940	HUMAN (VIOLENCE)
0950	HUMAN (COMMUNICABLE DISEASE)
0960	BACTERIA, VIRUS (NOT HUMAN CONTACT)

CODE	SOURCE OF INJURY NAME
1000	PERSONAL PROTECTIVE EQUIPMENT
1010	PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES
1020	RESPIRATOR, MASK
1021	DIVING EQUIPMENT
1030	SAFETY BELT, HARNESS
1040	PARACHUTE

INSTRUCTIONS FOR SECTION 6 — PUBLIC FATALITY

a. ACTIVITY AT TIME OF ACCIDENT—Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box. If the activity performed is not identified on the list, select from the *most* appropriate primary activity area (water related, non-water related or other activity), the code number for "Other", and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

1. Sailing
2. Boating—powered
3. Boating—unpowered
4. Water skiing
5. Fishing from boat
6. Fishing from bank dock or pier
7. Fishing while wading
8. Swimming/supervised area
9. Swimming/designated area
10. Swimming/other area
11. Underwater activities (skin diving, scuba, etc.)
12. Wading
13. Attempted rescue
14. Hunting from boat
15. Other

NON-WATER RELATED RECREATION

16. Hiking and walking
17. Climbing (general)
18. Camping/picnicking authorized area
19. Camping/picnicking unauthorized area
20. Guided tours
21. Hunting
22. Playground equipment
23. Sports/summer (baseball, football, etc.)
24. Sports/winter (skiing, sledding, snowmobiling etc.)
25. Cycling (bicycle, motorcycle, scooter)
26. Gliding
27. Parachuting
28. Other non-water related

OTHER ACTIVITIES

29. Unlawful acts (fights, riots, vandalism, etc.)
30. Food preparation/serving
31. Food consumption
32. Housekeeping
33. Sleeping
34. Pedestrian struck by vehicle
35. Pedestrian other acts
36. Suicide
37. "Other" activities

b. PERSONAL FLOTATION DEVICE USED—If fatality was water-related was the victim wearing a person flotation device? Mark the appropriate box.

INSTRUCTIONS FOR SECTION 7—MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE—Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

b. TYPE OF COLLISION—Mark appropriate box.

c. SEAT BELT—Mark appropriate box.

INSTRUCTIONS FOR SECTION 8—PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM—Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number (NSN) whenever applicable.

b. OWNERSHIP—Enter ownership for each item listed. (Enter one of the following: *USACE; OTHER GOVERNMENT; CONTRACTOR: PRIVATE)*

c. $ AMOUNT OF DAMAGE—Enter the total estimated dollar amount of damage (parts and labor), if any.

INSTRUCTIONS FOR SECTION 9—VESSEL/FLOATING PLANT ACCIDENT

a. TYPE OF VESSEL/FLOATING PLANT—Select the most appropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel/floating plant.

VESSEL/FLOATING PLANTS

1. ROW BOAT	7. DREDGE/DIPPER
2. SAIL BOAT	8. DREDGE/CLAMSHELL, BUCKET
3. MOTOR BOAT	9. DREDGE/PIPE LINE
4. BARGE	10. DREDGE/DUST PAN
5. DREDGE/HOPPER	11. TUG BOAT
6. DREDGE/SIDE CASTING	12. OTHER

b. COLLISION/MISHAP—Select from the list below the object(s) that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

1. COLLISION W/OTHER VESSEL	7. HAULAGE UNIT
2. UPPER GUIDE WALL	8. BREAKING TOW
3. UPPER LOCK GATES	9. TOW BREAKING UP
4. LOCK WALL	10. SWEPT DOWN ON DAM
5. LOWER LOCK GATES	11. BUOY/DOLPHIN/CELL
6. LOWER GUIDE WALL	12. WHARF OR DOCK
	13. OTHER

INSTRUCTIONS FOR SECTION 10—ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT—Fully describe the accident. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role(s) in the accident. Ensure that relationships between personnel and equipment are clearly specified. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11—CAUSAL FACTORS

a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain in item 13 below. Consider, as a minimum, the following:

(1) DESIGN—Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?

(2) INSPECTION/MAINTENANCE—Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?

(3) PERSON'S PHYSICAL CONDITION—Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was over exertion a factor?

(4) OPERATING PROCEDURES—Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?

(5) JOB PRACTICES—Were any of the provisions of the Safety and Health Requirements Manual (EM 385-1-1) violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice (including EM 385-1-1) fail to adequately address the task or work process? Would better job practices improve the safety of the task?

(6) HUMAN FACTORS—Was the person under undue stress (either internal or external to the job)? Did the task tend toward overloading the capabilities of the person; i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?

(7) ENVIRONMENTAL FACTORS—Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc., play a part in the accident?

(8) CHEMICAL AND PHYSICAL AGENT FACTORS—Did exposure to chemical agents (either single shift exposure or long-term exposure) such as dusts, fibers (asbestos, etc.), silica, gases (carbon monoxide, chlorine, etc.,), mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, by-products of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation (UV radiation created during welding, etc.) contribute to the accident/incident?

(9) OFFICE FACTORS—Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?

(10) SUPPORT FACTORS—Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources (in terms of employee skills, number of workers, and adequate supervision) available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc?

(11) PERSONAL PROTECTIVE EQUIPMENT—Did the person fail to use appropriate personal protective equipment (gloves, eye protection, hard-toed shoes, respirator, etc.) for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard(s)? Did lack of or inadequate maintenance of protective gear contribute to the accident?

(12) DRUGS/ALCOHOL—Is there any reason to believe the person's mental or physical capabilities, judgement, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".

b. WRITTEN JOB/ACTIVITY HAZARD ANALYSIS—Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident? Mark the appropriate box. *If one was performed, attach a copy of the analysis to the report.*

INSTRUCTIONS FOR SECTION 12—TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?—For the purpose of this section "trained" means the person has been provided the necessary information (either formal and/or on-the-job (OJT) training) to competently perform the activity/task in a safe and healthful manner.

b. TYPE OF TRAINING—Mark the appropriate box that best indicates the type of training; (classroom or on-the-job) that the injured person received before the accident happened.

c. DATE OF MOST RECENT TRAINING—Enter the month, day, and year of the last *formal* training completed that covered the activity-task being performed at the time of the accident.

INSTRUCTIONS FOR SECTION 13—CAUSES

a. DIRECT CAUSES—The direct cause is that single factor which most directly lead to the accident. See examples below.

b. INDIRECT CAUSES—Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.
Direct cause: failure to provide fall protection at elevation.
Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee (possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. (note USACE vehicle was in proper/safe working condition).
Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.
Indirect cause: Failure of employee to pay attention to driving (defensive driving).

INSTRUCTIONS FOR SECTION 14—ACTION TO ELIMINATE CAUSE(S)

DESCRIPTION—Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15—DATES FOR ACTION

a. BEGIN DATE—Enter the date when the corrective action(s) identified in Section 14 will begin.

b. COMPLETE DATE—Enter the date when the corrective action(s) identified in Section 14 will be completed.

c. TITLE AND SIGNATURE—Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE Supervisor shall also sign the report. Upon entering the information required in 15.d, 15.e and 15.f below, the responsible USACE supervisor shall forward the report for management review as indicated in Section 16.

d. DATE SIGNED—Enter the month, day, and year that the report was signed by the responsible supervisor.

e. ORGANIZATION NAME—For GOVERNMENT employee accidents enter the USACE organization name (Division, Branch, Section, etc.) of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15.c. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

f. OFFICE SYMBOL—Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15.e.

INSTRUCTIONS FOR SECTION 16—MANAGEMENT REVIEW (1st)

1ST REVIEW—Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15.c shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief (2nd review) for review and comment.

INSTRUCTIONS FOR SECTION 17—MANAGEMENT REVIEW (2nd)

2ND REVIEW—The FOA Staff Chief (i.e., FOA Chief of Construction, Operations, Engineering, Planning, etc.) shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18—SAFETY AND OCCUPATIONAL HEALTH REVIEW

3RD REVIEW—The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc, are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

INSTRUCTION FOR SECTION 19—COMMAND APPROVAL

4TH REVIEW—The FOA Commander shall (to include the person designated Acting Commander in his absence) review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.

Heat Stress Monitoring Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

Weather Conditions:			
Temperature degrees F.	Min:	Max:	Average:
Location of Work:			

Name	Time	Pulse Rate (Beats per Minute)	Weight

Comments:

Site Safety Officer:	Sr. UXO Supervisor/PM:

Ellis Environmental Group, L.C.

414 S.W. 140th Terrace, Newberry FL 32669 ▪ 352-332-3888 ▪ Fax: 352-332-3222

Hepatitis B Vaccine Declination

I understand that due to my occupation exposure to blood or other potentially infectious materials, I may be at risk of acquiring hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with hepatitis vaccine, at no charge to myself; however, I decline hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with hepatitis B vaccine, I can receive the vaccination series at no charge to me.

This requirement is in accordance with OSHA Regulations (Standards – 29 CFR)

- **Standard Number:** 1910.1030 App A
- **Standard Title:** hepatitis B Vaccine Declination (Mandatory)
- **SubPart Number:** Z
- **SubPart Title:** Toxic and Hazardous Substances

____
(Print Name)

____
(Sign Name)

____
(Date)

____
(Training Officer's Signature)

Safety Inspection Checklist

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: ______________
Day: ______________

Weather Conditions:				
Type of Inspection (check):	Daily:	Weekly:	Special:	Reinspection:
Location Inspected:				
Activity inspected:				

Inspection Requirement	Satisfactory	Unsatisfactory	N/A
Surface Sweep			
Subsurface Sweep			
Excavation Technique			
Personal Protection Equipment			
Work Practices			
Site Control			
First Aid Equipment			
Fire Fighting Equipment			
Explosive Transportation			
Explosive Storage			
Disposal Operations			
Overall Inspection Results			

Comments:

Worked stopped due to safety violations: Yes ___________ No ____________

Personnel Involved:

Corrective Measures:

Reinspection required: Yes ___________ No ____________

Signatures: I acknowledge that I have been briefed on the results of this inspection and will take corrective actions (If required)

Site Safety Officer:	Sr. UXO Supervisor/PM:

TAILGATE SAFETY BRIEFING / TRAINING FORM

Project Name: Culebra NTC Removal Action	Project No.:	Date:	Time:
Site H&S Officer:	Signature:		
Site Location: Culebra, PR	Type of Work: MEC Removal Action		
Tasks or Training:			

Protective Clothing/Equipment	
Chemical Hazards	
Physical / Biological Hazards	
Emergency Procedures	
Hospital/Directions	
Equipment Operation	
Explosive Hazards	
Permits/Utility Notifications	

Notes:

ATTENDEES

Print Name	Signature	Print Name	Signature

Visitor Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Date	Name	Title	Company	Safety Briefing Y/N	US Citizen Y/N	Time In	Time Out	Remarks

Wet Bulb Globe Temperature Log

Non-Time-Critical Removal Action at Municipality of Culebra, PR
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007

Page _____ of ______
Date: _____________
Day: _____________

Permissible WBGT Heat Exposure Threshold Limit Values			
Work / Rest Regimen (each hour)	Work Load		
	Light	Moderate	Heavy
Continuous Work	86°F	80°F	77°F
75% Work, 25% Rest	87°F	82°F	78°F
50% Work, 50% Rest	89°F	85°F	82°F
25% Work, 75% Rest	90°F	88°F	86°F

Date	Time	Dry Bulb Temp	WBGT Temp	Recommended Work / Rest Regimen (per hour) Work / Rest
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APPENDIX G

MSD Calculation Sheets

Minimum Separation Distances
Culebra
MK 76 25 lb Practice Bomb w/ Mk4 Spotting Charge
21 June 2005

REQUESTED BY: Terry Steuart
PREPARED BY: Michelle Crull, PhD, PE

This form shows calculated distances only. It does not constitute approval. Concurrence of CEHNC-OE-S is required to determine the applicable distance for a specific site.

In accordance with (IAW) EM 1110-1-4009, the minimum separation distance for unintentional detonations shall be the largest of the maximum fragment range, the K50 ($50W^{1/3}$ where W is the total net explosive weight for the detonation) overpressure distance or 200 ft. In accordance with (IAW) EM 1110-1-4009, use of the range to no more than 1 hazardous fragment/600 sq ft as the minimum separation distance for unintentional detonations requires written justification, a risk analysis, calculation of this distance by CEHNC-ED-CS-S, and concurrence of CEHNC-OE-S.

IAW EM 1110-1-4009, the minimum separation distance for intentional detonations shall be the largest of the maximum fragment range, the K328 ($328W^{1/3}$ where W is the total net explosive weight for the detonation) overpressure distance or 200 ft. The 200 ft is a default distance applied by USACE OE Safety and may be reduced by the appropriate approval authority (contact the MMRP-CX for instructions).

This calculation sheet is for a non-fragmenting practice munition. Therefore, MSD's will be the larger of the appropriate overpressure distance and 200 ft.

FILLER INFORMATION

Weight = 0.022 lbs
Type of filler = Red Phosphorous

CALCULATED OVERPRESSURE DISTANCES BASED ON OE ITEM'S EXPLOSIVE WEIGHT ONLY (i.e. NO DONOR CHARGE)

Range to 0.9 psi Overpressure (K50) = 14 ft
K328 Overpressure Range = 92 ft (based on munition NEW only, no donor)

SIGNATURES:

Michelle Crull 6/21/05 | Sherry [illegible] 6/21/05

Subject Matter Expert Date | QA Reviewer Date

FORM DATE 1 AUGUST 2003

FRAGMENTATION DATA REVIEW FORM

Category:	HE Rounds	DODIC:	C027
Munition:	75 mm M48	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	projectile	Individual Last Updated Record:	Crull
Secondary Database Category:	75 mm	Date Record Retired:	
Tertiary Database Category:	TNT		

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	1.47000
Diameter (in):	2.9528
Max Fragment Weight (lb):	0.153026
Critical Fragment Velocity (fps):	3471

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	234
Vertical Range of Maximum Weight Fragment (ft):	1297
Horizontal Range of Maximum Weight Fragment (ft):	1701

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	48
Inhabited Building Distance (09 psi), K50 Distance:	60
Intentional MSD (0065 psi), K328 Distance:	396

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	3.76
Mild Steel:	0.70
Hard Steel:	0.58
Aluminum:	1.45
LEXAN:	4.82
Plexi-glass:	3.27
Bullet Resist Glass:	2.69

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.153026
Critical Fragment Velocity (fps)SB:	3471
Kinetic Energy 106 (lb-ft2/s2)SB:	0.9218
Required Wall Roof Sandbag Thickness (in)SB:	24
Expected Maximum Sandbag Throw Distance (ft)SB:	125
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.153026
Critical Fragment Velocity (fps)W:	3471
Kinetic Energy 106 (lb-ft2/s2)W:	0.9218
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	200

Print This Form

Close Form

FRAGMENTATION DATA REVIEW FORM

Category:	HE Rounds
Munition:	20 mm M56A4
Primary Database Category:	projectile
Secondary Database Category:	20 mm
Tertiary Database Category:	H761 (RDX)
DODIC:	A890
Date Record Created:	7/30/2004
Last Date Record Updated:	7/30/2004
Individual Last Updated Record:	Crull
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	H761 (RDX)
Explosive Weight (lb):	0.02640
Diameter (in):	0.7874
Max Fragment Weight (lb):	0.000582
Critical Fragment Velocity (fps):	3183

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	200
Vertical Range of Maximum Weight Fragment (ft):	251
Horizontal Range of Maximum Weight Fragment (ft):	318

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	13
Inhabited Building Distance (09 psi), K50 Distance:	16
Intentional MSD (0065 psi), K328 Distance:	107

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	0.37
Mild Steel:	0.07
Hard Steel:	0.06
Aluminum:	0.17
LEXAN:	1.10
Plexi-glass:	0.46
Bullet Resist Glass:	0.31

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.000582
Critical Fragment Velocity (fps)SB:	3183
Kinetic Energy 106 (lb-ft2/s2)SB:	0.0030
Required Wall Roof Sandbag Thickness (in)SB:	12
Expected Maximum Sandbag Throw Distance (ft)SB:	25
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.000582
Critical Fragment Velocity (fps)W:	3183
Kinetic Energy 106 (lb-ft2/s2)W:	0.0030
Water Containment System:	5 gal carboys/ inflatable pool
Minimum Separation Distance (ft)W:	200/200

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FRAGMENTATION DATA REVIEW FORM

Category:	HE Rounds
Munition:	6"/47 Cal HC Mk34
Primary Database Category:	projectile
Secondary Database Category:	6 in
Tertiary Database Category:	Expl D
DODIC:	D402
Date Record Created:	7/30/2004
Last Date Record Updated:	7/30/2004
Individual Last Updated Record:	Crull
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	Explosive D
Explosive Weight (lb):	13.22000
Diameter (in):	6.0000
Max Fragment Weight (lb):	0.819549
Critical Fragment Velocity (fps):	3001

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	403
Vertical Range of Maximum Weight Fragment (ft):	1871
Horizontal Range of Maximum Weight Fragment (ft):	2510

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	94
Inhabited Building Distance (09 psi), K50 Distance:	117
Intentional MSD (0065 psi), K328 Distance:	768

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	5.66
Mild Steel:	1.04
Hard Steel:	0.86
Aluminum:	2.08
LEXAN:	6.27
Plexi-glass:	4.65
Bullet Resist Glass:	4.01

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.819549
Critical Fragment Velocity (fps)SB:	3001
Kinetic Energy 106 (lb-ft2/s2)SB:	3.6904
Required Wall Roof Sandbag Thickness (in)SB:	36
Expected Maximum Sandbag Throw Distance (ft)SB:	220
Minimum Separation Distance (ft)SB:	220

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.819549
Critical Fragment Velocity (fps)W:	3001
Kinetic Energy 106 (lb-ft2/s2)W:	3.6904
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	275

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FRAGMENTATION DATA REVIEW FORM

Category:	HE Bombs	DODIC:	E508
Munition:	1000 lb Bomb MK83	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	bomb	Individual Last Updated Record:	Crull
Secondary Database Category:	1000 lb	Date Record Retired:	
Tertiary Database Category:	H-6		

Munition Information and Fragmentation Characteristics

Explosive Type:	H-6
Explosive Weight (lb):	445.00000
Diameter (in):	13.9400
Max Fragment Weight (lb):	0.892311
Critical Fragment Velocity (fps):	6074

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	813
Vertical Range of Maximum Weight Fragment (ft):	2568
Horizontal Range of Maximum Weight Fragment (ft):	3288

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	361
Inhabited Building Distance (09 psi), K50 Distance:	452
Intentional MSD (0065 psi), K328 Distance:	2963

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	15.36
Mild Steel:	2.41
Hard Steel:	1.98
Aluminum:	4.89
LEXAN:	9.18
Plexi-glass:	7.67
Bullet Resist Glass:	6.64

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.892311
Critical Fragment Velocity (fps)SB:	6074
Kinetic Energy 106 (lb-ft2/s2)SB:	16.4602
Required Wall Roof Sandbag Thickness (in)SB:	NA
Expected Maximum Sandbag Throw Distance (ft)SB:	NA
Minimum Separation Distance (ft)SB:	NA

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.892311
Critical Fragment Velocity (fps)W:	6074
Kinetic Energy 106 (lb-ft2/s2)W:	16.4602
Water Containment System:	NA
Minimum Separation Distance (ft)W:	NA

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FRAGMENTATION DATA REVIEW FORM

Category:	HE Rounds	DODIC:	C122
Munition:	76 mm M352	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	projectile	Individual Last Updated Record:	Crull
Secondary Database Category:	76 mm	Date Record Retired:	
Tertiary Database Category:	Comp B		

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	1.46000
Diameter (in):	2.9921
Max Fragment Weight (lb):	0.229500
Critical Fragment Velocity (fps):	2507

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	253
Vertical Range of Maximum Weight Fragment (ft):	1291
Horizontal Range of Maximum Weight Fragment (ft):	1742

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	51
Inhabited Building Distance (09 psi), K50 Distance:	64
Intentional MSD (0065 psi), K328 Distance:	420

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	3.60
Mild Steel:	0.68
Hard Steel:	0.56
Aluminum:	1.42
LEXAN:	4.68
Plexi-glass:	3.16
Bullet Resist Glass:	2.62

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.229500
Critical Fragment Velocity (fps)SB:	2507
Kinetic Energy 106 (lb-ft2/s2)SB:	0.7212
Required Wall Roof Sandbag Thickness (in)SB:	24
Expected Maximum Sandbag Throw Distance (ft)SB:	125
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.229500
Critical Fragment Velocity (fps)W:	2507
Kinetic Energy 106 (lb-ft2/s2)W:	0.7212
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	200

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FRAGMENTATION DATA REVIEW FORM

Category:	HE Bombs	DODIC:	E480
Munition:	500 lb Bomb Mk 82 Mod 1	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	bomb	Individual Last Updated Record:	Crull
Secondary Database Category:	500 lb	Date Record Retired:	
Tertiary Database Category:	TNT		

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	242.00000
Diameter (in):	10.7500
Max Fragment Weight (lb):	0.896250
Critical Fragment Velocity (fps):	5193

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	688
Vertical Range of Maximum Weight Fragment (ft):	2462
Horizontal Range of Maximum Weight Fragment (ft):	3177

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	265
Inhabited Building Distance (09 psi), K50 Distance:	331
Intentional MSD (0065 psi), K328 Distance:	2172

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	11.47
Mild Steel:	1.87
Hard Steel:	1.54
Aluminum:	3.84
LEXAN:	7.93
Plexi-glass:	6.32
Bullet Resist Glass:	5.37

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.896250
Critical Fragment Velocity (fps)SB:	5193
Kinetic Energy 106 (lb-ft2/s2)SB:	12.0847
Required Wall Roof Sandbag Thickness (in)SB:	NA
Expected Maximum Sandbag Throw Distance (ft)SB:	NA
Minimum Separation Distance (ft)SB:	NA

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.896250
Critical Fragment Velocity (fps)W:	5193
Kinetic Energy 106 (lb-ft2/s2)W:	12.0847
Water Containment System:	NA
Minimum Separation Distance (ft)W:	NA

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FRAGMENTATION DATA REVIEW FORM

Category:	HE Rounds	DODIC:	
Munition:	3" Stokes	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	mortar	Individual Last Updated Record:	Crull
Secondary Database Category:	3 in	Date Record Retired:	
Tertiary Database Category:	TNT		

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	2.10000
Diameter (in):	3.0000
Max Fragment Weight (lb):	0.043600
Critical Fragment Velocity (fps):	6189

Theoretical Calculated Fragment Range

Range to No More Than 1 Hazardous Fragment/600 Square FeetA (ft):	219
Vertical Range of Maximum Weight Fragment (ft):	1071
Horizontal Range of Maximum Weight Fragment (ft):	1346

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	54
Inhabited Building Distance (09 psi), K50 Distance:	68
Intentional MSD (0065 psi), K328 Distance:	446

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	3.73
Mild Steel:	0.68
Hard Steel:	0.56
Aluminum:	1.46
LEXAN:	4.38
Plexi-glass:	2.87
Bullet Resist Glass:	2.26

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.043600
Critical Fragment Velocity (fps)SB:	6189
Kinetic Energy 106 (lb-ft2/s2)SB:	0.8350
Required Wall Roof Sandbag Thickness (in)SB:	24
Expected Maximum Sandbag Throw Distance (ft)SB:	125
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.043600
Critical Fragment Velocity (fps)W:	6189
Kinetic Energy 106 (lb-ft2/s2)W:	0.8350
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	200

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APPENDIX H

Resumés

Jeffrey Bleke, PE
Program Manager

Education:
BS, Civil Engineering, Louisiana State University, 1980

Registrations / Certifications:
Professional Engineer, Texas
American Society of Civil Engineers
Florida Engineering Society
National Society of Professional Engineers
Society of American Military Engineers
Certified LPST Professional, Texas
Notary Public, Florida

Experience:

Program Manager; Indefinite Delivery / Indefinite Quantity (ID/IQ) for Title I, Title II, and Other Architectural-Engineering (A-E) Environmental Requirements for Air Force Center for Environmental Excellence (AFCEE), Brooks Air Force Base (AFB), TX. Oversees all PMs and all delivery orders under this contract, including: Interim Remedial Action, Eglin AFB; Preliminary Assessment / Site Inspection (PA/SI), Barksdale AFB; Long-Term Groundwater Monitoring, F.E. Warren AFB; Investigation/Characterization, Elmendorf AFB; A-E Services, Naval Air Station (NAS) Fort Worth Joint Reserve Base (JRB); Third Party Validation, Massachusetts Military Reservation (MMR); Title II Services at various construction projects throughout the continental United States (CONUS).

Program Manager; Ordnance and Explosives (OE) and Construction Support, Culebra Island National Wildlife Refuge, PR. Oversaw and directed all EEG personnel and PMs to ensure that all requirements were met. Project included construction support for OE/UXO clearance activities supporting construction of electrical wind generator and desalination facility, improvement of existing roads, UXO avoidance during injection of underground cable, and surface clearance of 100 acres of UXO-contaminated migratory bird-nesting area. Culebra Island archipelago was used as live-fire impact range from 1903 until 1975. Construction support and earth-moving was conducted in this live-fire impact area.

Program Manager; United States Navy, Fleet, and Industrial Supply Center, Seal Beach, CA; Geophysical Location of Ordnance at Pine Castle Bombing Range, Altoona, FL. Directed EEG personnel and oversaw PMs to ensure that all requirements in contract were met. Project involved use of magnetic sensors in both aerial and surface mode, and use of EM-61s to detect subsurface ordnance items in open areas (approximately 475 acres) and location of surface ordnance in more than 1,000 acres of wooded area at bombing range. Work was completed in less than one month.

Principal-in-Charge; Several United States Navy Contracts. Negotiated contracts at NAS Jacksonville and Naval Station (NS) Mayport, Key West, and Pensacola, in Florida. Provided technical support and assisted PMs with contract administration. Managed $15 million Solution Order Concept for demolition projects in the southeast United States. Negotiated over $20 million in design/build renovation projects at installations in Key West, Pensacola, Panama City, Meridian, and Jacksonville. These projects included officers' and enlisted men's quarters and Naval Exchange Command facilities. All projects to date have been completed and have Construction Contractor Appraisal Support System (CCASS) performance evaluations of "Outstanding." Project components include remediation of hazardous materials, construction, demolition, and waste removal in wetlands. Total value of Navy contracts exceeds $20 million.

Program Director; United States Army Corps of Engineers (USACE) Huntsville; Ordnance Removal Contract, Gainesville, FL. Managed more than $24 million worth of contracts for UXO services and A-E support. Acted as program manager and professional engineer in charge for multiple task orders, including time-and-materials and firm-fixed-price task orders, at locations worldwide, including the Panama Canal zone, Louisiana, California, New York, Texas, New Mexico, Arkansas, and Florida.

Program Director; USACE Programs; Gainesville, FL. As program director for major Environmental Science & Engineering, Inc. contracts, managed more than $50 million worth of contracts for several USACE clients, including Huntsville, Mobile, Jacksonville, Louisville, Nashville, Fort Worth, Kansas City, Savannah, Omaha, Tulsa, and Sacramento. Contract types were cost-plus-fixed-fee, firm-fixed-price, and cost-plus-award-fee. Negotiated several multi-million-dollar delivery orders, provided contract management, and interfaced with clients to ensure that all client requirements were met.

Program Manager; USACE Huntsville; Cost-Plus-Fixed-Fee Contract for Hazardous, Toxic, and Radioactive Waste (HTRW) and Ordnance. Served as professional engineer in charge for more than 20 Formerly Used Defense Sites (FUDS) in CONUS, the United States Virgin Islands, and Puerto Rico. Negotiated delivery orders within this contract with both PMs and contracting officers. Interfaced with PMs and project team members to ensure that requirements of contracts were met. Responsible for the completion of real-time cost progress-tracking system to assist PMs with meeting requirements of project. As a result, costs incurred during project did not exceed contract requirements. System was used by PMs to assist with monthly progress reports.

Project Director; USACE Kansas City District; Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments and Reauthorization Act (SARA) Underground Storage Tank (UST), and HTRW Services at Military Installations and Superfund Sites Nationwide. Provided contract management support, assisted with negotiations, provided remediation support for several projects with USACE Kansas City to determine extent of contamination and to implement remedial solutions for sites identified under DoD Defense Environmental Restoration Program (DERP) or through Environmental Protection Agency (EPA) or state RCRA and CERCLA/SARA programs. Project involvement included: Thermal Treatment, Lipari Landfill National Priorities List (NPL) Site, Pittman, NJ; Contamination

Evaluation and Remedial Design, Old Burn Pit, Leavenworth, KS; Landfill Closure, Fort Benning, GA.

Project Director; USACE Huntsville; Site Sampling / Groundwater Monitoring to Amend Existing Remedial Investigation / Feasibility Study (RI/FS) Reports, DDRC DLA Facility, Shelby County, TN. Project involved sampling and analysis for existing monitoring wells. Information was used to modify an existing RI/FS report in accordance with EPA QAMS 005/80 format.

Project Director / Project Manager; USACE Huntsville; Site Characterization and Remedial Designs, Engineering Evaluations / Cost Analyses (EE/CAs), Ordnance Removal at FUDS. Included Camp Sibert, Withlacoochie Air Field, Laurinburg-Maxon AFB, North Carolina; Brooksville Army Air Base, Florida; Camp Croft, Fort Segerra, Culebra Island, Camp Claiborne, Southwest Proving Grounds, Camp Green, Indian Rocks Beach, Fort Pierce, and Pantex. Performed studies under CERCLA to determine areas contaminated or potentially contaminated with chemical agent or conventional ordnance, and to estimate nature and amount of contamination. Studies involved performing archive searches on the specific sites and utilizing the data to follow up with geophysical investigations. Information was submitted to required agencies as detailed site characterization reports and used to provide recommendations for design of removal or remedial actions for each location. Individual project values averaged $600,000. These high-profile projects involved extensive coordination with subcontractors, regulatory agencies, several USACE districts, and the public.

Project Manager; USACE Huntsville; RCRA Facility Investigation, Redstone Arsenal, Huntsville, AL. Managed RI for potential contamination of soils and groundwater in and around six solid waste management units (SWMUs). Negotiated contracts, provided technical support. Work involved preparing work plan, surveying soil gas, preparing site, drilling and sampling monitoring wells, writing RI report.

Project Manager; Confidential Client; Incinerator Specification and Design. Wrote specifications for incineration and related equipment for a CERCLA remediation and incineration project. Equipment specified included baghouse, rotary kiln, rotary drier, materials handling system, ash quench system, secondary combustion chamber, and emergency backup system. This equipment was used to thermally destroy hazardous wastes at a Superfund site.

Project Director; USACE Huntsville; Corrective Action Management Plan (CAMP), Redstone Arsenal, Huntsville, AL. Directed CAMP report activities for Redstone Arsenal defining and prioritizing more than 200 SWMUs. Report used as basis for further action at facility following RCRA guidelines.

Project Director; USACE Huntsville; Corrective Measures Study, Redstone Arsenal, Huntsville, AL. Directed corrective measures study that recommended methodology to clean up contamination at 10 SWMUs at Redstone Arsenal. Recommendations based on type of contamination, available technologies, innovative technologies, and cost. Report used as basis for further RCRA action at site.

Manager of Engineering / Project Manager, Dallas, TX. Managed engineering, design, and startup of world's largest mobile infrared incinerator. Incinerator was designed for thermal destruction of polychlorinated biphenyls (PCBs) and dioxins and was eventually permitted for doing so under RCRA. System was set up and used to successfully destroy contaminated soils at several former steel plant locations throughout Florida. Conducted trial burns to obtain necessary permits, and negotiated all aspects of contract with client companies that purchased system.

Plant Associate Civil Engineer, Houston, TX. Performed civil engineering duties as required for large steel mill operation, including foundation design, plant surveying, structural design, air quality permitting, wastewater process plant design, furnace design and modifications, and environmental engineering.

Mark Bagel, PG
Project Manager

Education:
BA, Geology, State University of New York, 1978

Registrations / Certifications:
Professional Geologist, Florida
Professional Geologist, Arkansas
Professional Geologist, Alabama
Hazardous Waste Operations & Emergency Response (HAZWOPER) 40-Hour Training & Annual Updates
Association of Engineering Geologists
Association of Groundwater Scientists & Engineers
Geological Society of America
Certified, First Aid & Cardiovascular Pulmonary Resuscitation (CPR)
Environmental Train-the-Trainer Course
American Society for Testing & Materials (ASTM)
USACE Construction QC Course

Experience:

Site Manager / Project Manager; USACE Louisville District; RI at NAS Grosse Ile / Nike Site D-51, Grosse Ile, MI. Responsible for managing an RI at 13 former UST sites. Tanks held various products including waste oil, gasoline, diesel, and fuel oil. One site has an associated solvent plume. Project included the coordination and preparation of a Field Sampling Plan, Quality Assurance Project Plan, Community Relations Plan, Quality Control Plan, and Safety and Health Plan. Responsibilities included invoicing the client, interfacing with the client over technical issues, and attending planning meetings. EEG, USACE, and the Michigan Department of Environmental Quality Environmental Response Division teamed up to provide a scope of work that was both cost-effective and met the state requirements. As part of the scope, EEG prepared a database with data from past and present investigations in order to complete a risk assessment and in support of the final report. A total of 21 wells and 35 soil borings were installed during the field effort. A final report was prepared including a Quality Control Summary Report.

Site QC Manager / Assistant Project Manager; USACE Kansas City District; RI at Forbes Atlas S-9 Missile Site, Holton, KS. Responsible for managing an RI work plan at the former missile site. The former missile silo was converted into a high school, with an elementary school constructed nearby. The project included indoor air sampling to assess the potential effect on the students. The major chemicals of concern at this site were generally solvents. Responsibilities included invoicing the client, interfacing with the client over technical issues, and attending planning meetings. Project included the coordination and preparation of a Field Sampling Plan, Quality Assurance Project Plan, Community Relations Plan, Quality Control Plan, and Safety and Health Plan. During the field effort, was responsible for QC of the site and data. A total of 5 wells and 31 Geoprobe borings were installed during the field effort, which included the measurement of water flow from the sumps, Global Positioning System (GPS) of the site boundaries, installation of 10 piezometers to aid in the installation of monitoring wells, sampling of groundwater and soils from both the wells and the Geoprobe borings, and collection of surface water and sediment. A final report was prepared including a Quality Control Summary Report.

Waste Specialist; RCRA Investigation, Eglin AFB, FL. Prepared UXO Avoidance Safety Plan for the collection of shallow surface soils at a demolition training area within Eglin AFB.

Site Manager / Project Manager; USACE Huntsville; Culebra Island FUDS; UXO Construction Support, Culebra National Wildlife Refuge, PR. Responsible for managing UXO operations in support of construction of a desalinization plant and a wind generator. The project involved preparing a Work Plan and a site-specific Safety, Health, and Emergency Response Plan; preparing an Explosives Safety Submittal approved by Department of Defense Explosives Safety Board (DDESB); interfacing with federal and local agencies for the protection of endangered species; and preparing a geophysical plan, environmental protection plan, and several USACE-required plans. Prepared progress reports using a project database. Demolition operations required close coordination with the Federal Aviation Authority, as the site was located along the flight path to the only airport on Culebra Island. Due to EEG's performance on this project, EEG was given a modification to extend its contract along with modifications to conduct surface removal of ordnance at 69 acres of the National Wildlife Refuge and subsurface removal of UXO to a depth of 4 feet along the roads, an observation post, and firebreaks. The project involved use of innovative technologies in some areas to complete extensive vegetation clearance and additional work at the site. The project is currently ongoing. As PM, responsibilities included training senior site personnel in proper QC management of site data.

Project Manager; USACE Louisville District; Biannual Groundwater Monitoring, West Landfill at Fort Benjamin Harrison, Indianapolis, IN. Responsible for management during the biannual compliance monitoring of wells, seeps, and gas monitoring wells in support of the closure permit of the landfill. Project included preparation and submittal of two biannual compliance reports to the Indiana Department of Environmental Management.

Data / Safety Quality Assurance (QA) Manager; United States Navy, Fleet, and Industrial Supply Center, Seal Beach, CA; Geophysical Location of Ordnance at Pine Castle Bombing Range, Altoona, FL. Responsible for contract compliance of field operations. Responsible for compliance issues during safety and QC audits performed by the Navy to ensure that operations met the requirements of the contract. Performed unannounced compliance audits to ensure that geophysical operations met the requirements of the contract. Audited data collection procedures, data quality checks, background data collection, data processing, and safety compliance. Project involved use of magnetic sensors in both aerial and surface mode, and use of EM-61 to detect subsurface ordnance items in open areas (approximately 475 acres) and location of surface ordnance in over 1,000 acres of wooded area at a bombing range. The work was completed in less than one month. Provided safety training and paper management training to site personnel.

Project Manager; USACE Louisville District; PA at Former Willow Springs Test Cells Site, Willow Springs, IL. Managed PA of a former jet engine test cells site. Project included a geophysical investigation, excavation of test pits, data collection and review, and archive search to assess the potential source areas of solvent contamination in the soil and groundwater.

Site Manager / Project Manager; USACE Louisville District; RI/FS of Nike Site C-45, Gary Regional Airport, Gary, IN. Responsible for scoping, costing, and implementing a CERCLA RI/FS conducted at a former Nike C-45 missile site. Project involved the environmental investigation of a missile assembly building, generator building, acid fueling station, acid storage shed, and two emergency generator underground fuel storage tanks. Project plans, including a Field Sampling Plan, Site Safety and Health Plan, and Quality Assurance Plan, were prepared and approved by USACE prior to the field effort. Scope of work included collection of surface soil samples, surface water samples from abandoned silos, subsurface soil and water using a Geoprobe, and tank content samples, and collection of subsurface soil samples and well installation using a drill rig. Quarterly water samples were collected from each well. The analytical samples were collected for both organic and inorganic analyses. Responsible for preparing the RI/FS report. As site manager, ultimately responsible for site-specific safety training and daily safety briefings.

Project Manager; VG Southcap Properties; Solvent Contamination Assessment at Former Alpine Cleaners, Rockledge, FL. Contamination assessment at a former dry-cleaning site. Solvents detected at the site include trichloroethene (TCE), vinyl chloride, tetrachloroethene (PCE), perchloroethene, and other solvent breakdown products.

Project Manager; USACE Mobile; Soil Removal in Areas 13 and 14 in Area A at Former Alabama Army Ammunition Plant, Childersburg, AL. Assisted with costing of field tasks, review and preparation of work plan and safety plan. Project involved the soil removal at two sites. Area 13 soils were contaminated with benzo(a)pyrene (BAP). Twelve cubic yards of contaminated soils were excavated from the area and placed in a roll-off for transportation and incineration in accordance with the Record of Decision. Soil samples were collected from the excavated area to determine that clean-up levels for BAP were met. The excavated area was subsequently backfilled. The lead-contaminated soil in Area 14 was located at the end of a cannon tunnel. The cannon tunnel was used to test projectile velocities, with the projectiles impacting a soil pile at the end of the tunnel. EEG was scoped to remove 26 cubic yards of soil from the tunnel. Due to the level of contamination at 26 cubic yards, the contract was modified to allow additional excavation of soils. X-ray fluorescence was used to screen samples for lead during the field effort. Acted as site manager and responsible for activities during the field effort, including site-specific safety training and daily safety briefings. Prepared monthly reports and cost estimates for additional scope of work.

Site / QA Manager; FUDS, USACE Huntsville; Former Camp Croft Training Facility EE/CA, Spartanburg, SC. Assisted with costing field tasks, preparing work plan, and field activities leading up to the EE/CA field investigation. Daily management of the field effort including preparing a database for tracking daily field data; preparing daily reports; maintaining an investigation schedule; QA of field data from UXO subcontractor during the geophysical investigation of ordnance-contaminated sites; analysis of site data using GridStats and SiteStats software; interfacing with the field teams, site surveyor, PM, and client during field activities; and acting as safety representative for Environmental Science & Engineering, Inc. during the field effort. Responsible for preparing the site EE/CA report outline and assisting with the Ordnance and Explosives Cost Effectiveness Risk Took (OECert) analysis of the field data. Prepared a Field

Investigation Equipment Plan, which evaluated the options for the geophysical investigation as part of the EE/CA investigation.

Site Manager / Project Manager; USACE Huntsville; FUDS EE/CA, Culebra Island, PR. Responsible for all site work in support of an EE/CA to identify and evaluate ordnance-contaminated sites on Culebra Island and the surrounding cays. Project involved preparing a Work Plan and a Safety, Health, and Emergency Response Plan; conducting a records review; interfacing with federal and local agencies for the protection of endangered species of plants and animals; archive records review; conducting local interviews and attending public meetings; geophysical investigation; ordnance-contaminated site investigation and analysis using GridStats software; surveying and mapping; and writing the site EE/CA report. Management duties included preparation of monthly report, budget management, and client interface.

Site Manager; USACE Huntsville; FUDS, Phase I, Former Chemical Warfare Training Facility, Camp Sibert, Gadsden, AL. Responsible for all site work for a site characterization investigation to safely locate and identify suspected burial pits and trenches that might contain MEC, munitions constituents (MC), and chemical warfare materiel (CWM). Project involved preparing a Work Plan and a Safety, Health, and Emergency Response Plan; conducting a records review; archive records search; geophysical investigation, including daily review of equipment standard check data; high-impact area investigation; surveying and mapping; and writing the site characterization report.

Michael Zaloudek
Senior UXO Supervisor

Education:
Basic EOD School, Indian Head, 1974
BS, Biology, Northwestern State University, 1967

Registrations / Certifications*:*
15 Hours for MA in Asian Studies; University Philippines
Nuclear Weapons Orientation Advanced Course; Kirtland AFB, NM
US Army Chemical/Biological School; Redstone, AL
Explosive/Nuclear/Missile Safety School; Lowery AFB, CO
US Air Force Munitions Officer Course; Lowery AFB, CO
OSHA 40-Hour Hazardous Waste Site Workers Course
OSHA 8-Hour Supervisory Training Course

Experience:

UXO Supervisor; UXO Avoidance & Scrap Demilitarization, Culebra, PR. Responsibilities include UXO avoidance during fence construction and the demilitarization of UXO scrap using a bandsaw. Provided certification of ammunition, explosives, and dangerous articles (AEDA) and scrap for disposal.

Senior UXO Supervisor; UXO & Scrap Removal, Camden, AR. Responsibilities include management of two field teams and QA/QC personnel during UXO and scrap removal action. Provide certification of AEDA and scrap for disposal at a local dealer, identify and destroy UXO items. Project includes excavation of geophysical anomalies for scrap and UXO removal.

UXO Operations Manager / Project Manager; Various Projects. Responsible for the management of several projects, including target range scrap removal at Eglin AFB, and safety escort during an environmental sampling effort at Mill Creek, Fort Knox, KY. Use of geophysical equipment to ensure safe passage

Safety Escort and Project Manager; Culebra Construction Support. Performed safety escort during initial site visit. Acted as PM during PM's absence. Responsible for UXO management procedures.

Senior UXO Supervisor; Geophysical Mapping and Locating of UXO; Pine Castle Impact Range; Altoona, FL. Responsible for the site management of two UXO/geophysical survey teams. Responsible for the management of the field team, scheduling, coordination with Pine Castle range personnel, ensure the completion of tasks done in accordance with the scope of work.

Safety Escort; Culebra Island Site Visit. Performed UXO avoidance during site visit. Provided site training and UXO avoidance procedures during site visit.

Senior UXO Supervisor; EE/CA at Former Southwest Proving Ground; Hope, AR. Responsible for project management but periodically performed as SUXOS during long-term project.

Senior Project Manager; Site Characterizations; Various Projects; EOD Technology, Inc.; Oak Ridge, TN. Redstone Arsenal, Huntsville, AL; Former Camp-Sibert, Gadsen, AL; Former Laurinburg-Maxton Army Air Base, Laurinburg, NC; Former Brooksville Army Air Field, Brooksville, FL; Former Withlacoochee-Air Field, Brooksville, FL; Former Camp Croft Army Training Facility, Spartanburg, SC; Former Camp Claiborne, Alexandria, LA; Former Culebra Naval Range, Culebra Island, PR, site visit; United States Army Target Facility, Duck, NC; United States Army Reserve Center Local Training Area, LaPort, IN; Nitrocellulose at Blue Grass Arsenal, KY; Pueblo Arsenal, CO; UXO avoidance for oil line and UXO clearance in roadway at Black Hills Army Depot, SD; UXO clearance at Richard Gebaur AFB, IL ; UXO avoidance at Pantex, TX, facility; UXO EE/CA at Former Camp Greene, NC; UXO removal action at Former Fort Irwin, CA; UXO investigation at Fort Gordon, SC; UXO EE/CA at Former Fort Pierce, FL.

Senior UXO Supervisor; Removal Action at the Erie Ordnance Depot; Port Clinton, OH. Responsible for the management of operations including several field teams. Provided certification of AEDA and scrap for disposal at a local dealer, identify and destroy UXO items. Project included excavation of geophysical anomalies for scrap and UXO removal.

Senior UXO Supervisor / UXO Safety Officer; Summit Equipment and Supply (SES) Superfund Site; Akron, OH. Responsible for the operations and management of a removal action for PCB-contaminated soil, scrap metal, and UXO found at this site. Provided certification of AEDA and scrap for disposal at a local dealer, identify and destroy UXO items. Project included excavation of geophysical anomalies for scrap and UXO removal. Documented the removal of PCB-contaminated soil.

Gary H. Tourtellotte, MS
Site Manager

Education:

BS, Biology, University of Miami, 1974

MS, Oceanography, Old Dominion University, 1979

Registrations / Certifications:

Hazardous Waste Operations & Emergency Response (HAZWOPER) 40-Hour Training & Annual Updates
Certified, First Aid & Cardiovascular Pulmonary Resuscitation (CPR)
USACE Construction QC Course

Experience:

Site Manager; Location and Identification of Unexploded Ordnance (UXO), Ordnance and Explosive Waste (OEW), and Chemical Warfare Materiel (CWM), Former Withlacoochee Air Field, Formerly Used Defense Sites (FUDS), U.S. Army Corps of Engineers (USACE), Huntsville Division. Responsible for all site work for a site characterization investigation to safely locate and identify UXO, OEW, and CWM at the Former Withlacoochee Air Field in Hernando and Sumter counties, Florida. Project involves preparing a work plan and safety, health, and emergency response plan; conducting a records review, archive records search, visual reconnaissance of 20 sites, geophysical investigations of 5 sites, surveying and mapping; and writing the site characterization report.

NEPA Specialist; Programmatic Environmental Assessment of Air to Ground Training Areas, Eglin Air Force Base, Florida. Authored Draft PEA with respect to Air to Ground gunnery training areas at Eglin AFB, Florida. Evaluated training and aircraft operations and their potential impacts with respect to threatened and endangered species, critical habitats, surface and groundwater quality, potential soil contamination from metals and munitions explosives' compounds, aging target vehicles, and environmental justice. Significant issues considered included potential noise effects to wildlife; and metals and explosive compound deposition resulting from expended ordinance.

Project Manager / NEPA Specialist; Biological Assessment (BA) for the Potential Impacts of Underwater Detonations, Eglin Air Force Base, Florida. Project to evaluate the potential impacts of underwater detonations of various configurations of explosives proposed to be conducted in the surf zone of Santa Rosa Island. Underwater propagation of energy as a result from the detonations was modeled and predictions made on the number of marine mammals, sea turtles, and Gulf sturgeon that might be impacted. Potential takes of marine mammals are required under the Marine Mammal Protection Act. Sea turtles and Gulf sturgeon are subject to the Endangered Species Act. The BA was used for documentation and consultation with the National Marine Fisheries Service in acquiring permits for the proposed actions.

Assistant Project Manager / NEPA Specialist; Environmental Assessment (EA), Santa Rosa Island Reconstitution of Test Capabilities, Eglin AFB, Florida. Conducted EA in the coastal zone of Eglin AFB. The Proposed Action was to reconstitute the test capabilities of Santa Rosa Island that were severely impacted by the destruction caused during Hurricane Opal in 1995. This Environmental Assessment (EA) was prepared as part of the Environmental Impact Analysis Process (EIAP) in accordance with Air Force Instruction (AFI) 32-7061 that implements the National Environmental Policy Act (NEPA), the President's Council on Environmental Quality (CEQ) regulations [40 Code of Federal Regulations (CFR) Parts 1500 to 1508], and Department of Defense Directive 6050.1, July 1979. The EA was subject to Clearinghouse consistency review under the Coastal Zone Management Act. Prepared responses to comments resulting from public participation reviews and agency CZMA consistency reviews. Significant issues included marine and terrestrial threatened and endangered species, beach dune habitats, migratory coastal birds, viewshed impacts, and low flying jet aircraft noise.

Project Ecologist; RCRA Part B Permit, Galson/Andersen Air Force Base (AFB), Guam USA. Project was for the preparation of a RCRA Part B permit application for the operation of the Andersen AFB explosives ordnance disposal (EOD) range. As project ecologist, prepared documentation on ecological and socioeconomic resources of the project area on Guam. Documentation included descriptions of terrestrial and nearshore reef flat communities and ecology; beach communities and ecology; rare, threatened and endangered species occurrences and ecology; and land use and demographics. Collected groundwater, surface water, and soils samples for identification of COPCs. Provided locations of potential human and non-human receptors, and assisted in development of potential exposure pathways for risk assessment of EOD operations.

Project Ecologist; Solid Waste Management Units (SWMUs) Ecological Rankings, Redstone Arsenal. Investigated SWMUs at Redstone Arsenal, Huntsville, Alabama. Provided descriptions of ecological settings of SWMUs and provided rankings based upon ecological criteria for SWMU prioritization.

Project Ecologist; Ecological Surveys, Alabama Army Ammunition Depot (AAAP). Conducted field surveys consisting of bird surveys, small mammal trapping, and mammal observations for assessing the ecological risks associated with past operations of AAAP. Assessed and developed potential exposure pathways and exposure scenarios of biota to contaminants of concern. Assessed the fish community composition of beaver ponds.

Field Operations Manager / Senior Project Ecologist; Contamination Assessment, PPG Industries, Lake Charles, Louisiana. Conducted fish, invertebrate, sediment, and water quality surveys to determine the extent of contamination of biota, sediments, and surface water with chlorinated hydrocarbons, mercury, and PCBs in the Calcasieu River Estuary and upper Calcasieu River watershed. Primary study focus was on hexachlorobenzene and hexachlorobutadiene concentrations in important recreational and commercial species as primary target species which included; blue crab, red drum, speckled sea trout, black drum, flounder, oysters, and shrimp. Strict QA/QC procedures were required in the field processing of biotic, water, and sediment quality samples to prevent potential cross contamination of samples. Provided data analysis, preparation of annual reports, and presentations.

Project Ecologist; Ecological Survey, Mid South Utilities. Conducted field investigations and provided habitat descriptions of tropical marine communities at Grand Bahama Island, Bahamas. Field investigations included the collection of infaunal macroinvertebrates, fishes, zooplankton, ichthyoplankton, phytoplankton, and periphyton. *In situ* observations utilizing SCUBA were conducted to identify and describe fishes, corals, and algae of live bottom and coral reef communities of the project site. Prepared baseline documentation and potential impacts of a once through cooling system on tropical marine communities.

Karen Hatfield, MS
Chemist

Education:
BS, Chemistry, University of Florida, 1971
MS, Environmental Engineering Sciences, University of Florida, 1972

Registrations / Certifications:
Florida Society of Environmental Analysts (FSEA)

Experience:

Chemist; USACE Kansas City District; Source Area Wide Assessment for Former Camp Crowder Engine Testing Area, Neosho, MO. Responsible for coordinating the field effort with the laboratory, for the review of soil and water quality data that were analyzed for inorganic and organic constituents. The main contaminants studied were volatile organic compounds (VOCs). Responsible for compiling the Laboratory Quality Assurance Project Plan, validating the data, and writing the Quality Control Summary Report.

Chemist; USACE Kansas City District; RI/SI at Tyson Valley Powder Farm, Eureka, MO. Responsible for coordinating the field effort with the laboratory for the analyses of soil and water samples, which were analyzed for inorganic and organic compounds, and explosive constituents. The main contaminants studied were VOCs and explosive compounds. Responsible for compiling the Laboratory Quality Assurance Project Plan, validating the data, and writing the Quality Control Summary Report.

Chemist; USACE Kansas City District; Phase I RI Sampling and Analysis, Former Forbes Atlas Missile Site S-9, Holton, KS. Responsible for coordinating the field effort with the laboratory for the analyses of soil and water samples, which were analyzed for anions, herbicides, pesticides, PCBs, classical chemistry, polynuclear aromatic hydrocarbons (PAHs), metals, VOCs, and semi-volatile organic compounds (SVOCs). Responsible for compiling the Laboratory Quality Assurance Project Plan, validating the data, and writing the Quality Control Summary Report.

Chemist; USACE Louisville District; Phase I RI Sampling and Analysis; Former NAS Grosse Ile / Nike Site D-51, Grosse Ile, MI. Responsible for coordinating the field effort with the laboratory for the analyses of soil and water samples, which were analyzed for PAHs, metals, VOCs, PCBs, and SVOCs. Responsible for compiling the Laboratory Quality Assurance Project Plan, validating the data, and writing the Quality Control Summary Report.

Chemist; AFCEE; RCRA Facility Investigation of Waste Accumulation Areas, NAS Fort Worth JRB, TX. Responsible for coordinating the field effort with the laboratory for the analyses of soil and water samples, which were analyzed for PAHs, metals, VOCs, SVOCs, TNRCC 1005/TPH, and pesticides/PCBs. Also responsible for validating the data, and writing the chemistry section of the final report.

Chemist; AFCEE; RCRA Facility Assessment, Eglin AFB, FL. Responsible for coordinating the field effort with the laboratory for the analyses of soil and water samples, which were analyzed for Target Analyte List (TAL) metals, VOCs, SVOCs, explosives, PCBs, pesticides, and herbicides. Responsible for compiling the Laboratory Quality Assurance Project Plan and reviewing QC data with the laboratory.

APPENDIX I

Conceptual Site Model

Contents

Figures

Abbreviations & Acronyms

ASR	Archives Search Report
BCF	bioconcentration factor
CEHNC	United States Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESAJ	United States Army Corps of Engineers, Jacksonville District
CFR	Code of Federal Regulations
CSM	Conceptual Site Model
CWM	chemical warfare material
DNER	Department of Natural and Environmental Resources
DoD	Department of Defense
EE/CA	Engineering Evaluation / Cost Analysis
EEG	Ellis Environmental Group, LC
EPA	Environmental Protection Agency
ESA	Endangered Species Act
ESE	Environmental Science and Engineering, Inc.
FDE	Findings and Determination of Eligibility
FR	Federal Register
FWS	Fish and Wildlife Service
L	liter
MC	munitions constituent
MEC	munitions and explosives of concern
mg	milligram
mm	millimeter
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OOU	ordnance operable unit
RCRA	Resource Conservation and Recovery Act
TPP	Technical Project Planning
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance

1.0 Preface

1.0.01 The Conceptual Site Model (CSM) is an integral part of the Technical Project Planning (TPP) process. The target audience is the Project Delivery Team (USACE 2003).

1.0.02 The CSM is a description of a site and its environment that is based on existing knowledge. It describes sources and receptors, and the interactions that link these. It assists the team in planning, interpreting data, and communicating. The CSM will provide a planning tool to integrate information from a variety of resources, to evaluate the information with respect to project objectives and data needs, and to respond through an iterative process for further data collection or action.

1.0.03 The CSM describes sources of contaminants; actual, potentially complete, or incomplete exposure pathways; current or reasonable proposed property uses; and potential receptors.

2.0 Introduction

2.0.01 Ellis Environmental Group, LC (EEG), under contract to the United States Army Engineering and Support Center, Huntsville (CEHNC), is providing non-time-critical removal operations on Culebra Island and several adjacent cays, in Puerto Rico. This area was used during the period of 1903 through 1975 by the Department of Defense (DoD) for numerous military maneuvers and range training. This conceptual site model will describe the site and its environment based on the existing knowledge, the sources and receptors, and interactions between them.

2.0.02 Culebra Island has about 24 adjacent cays, mostly owned by the United States Fish and Wildlife Service (FWS). The total land area is approximately 7,300 acres, of which approximately 1,500 acres are owned by FWS. The Commonwealth of Puerto Rico owns the remainder, where approximately 1,200 acres are primarily in the custody of the Department of Natural and Environmental Resources (DNER), and approximately 4,600 acres are owned by private citizens. The DNER ownership extends from the high-tide mark to 9 miles offshore.

2.0.03 Culebra Island is separated from Puerto Rico by approximately 17 miles of the Vieques Sound. The Caribbean Sea lies to the south, and the Atlantic Ocean lies to the north. The warm, clear waters provide habitat for a variety of sea life and attract scuba divers from around the world.

2.0.04 Surface clearance of munitions and explosives of concern (MEC) will be conducted at 30 acres on the western flank of Cerro Balcon, 82 acres of the northwest end of Isla Culebrita, and up to 39.5 acres of additional cays, including Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza. These sites are identified in Map B-1 in Appendix B of the Work Plan.

3.0 Profile Information Resources

3.0.01 The Findings and Determination of Eligibility (FDE), dated December 24, 1991, qualified 2,660 acres of Culebra Island and the adjacent cays as eligible for consideration under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS); however, upon completion of the site visit and review of historical material from the National Archives, it was determined that all of Culebra Island and the adjacent cays should be considered a FUDS.

3.0.02 The United States Army Corps of Engineers (USACE), Rock Island District, compiled an Archives Search Report (ASR), dated February 1995. The ASR determined the types, quantities, and probable locations of MEC remaining at the Culebra Island National Wildlife Refuge. The ASR identified 32 suspected areas. Ordnance was verified at 11 sites. These sites included Cerro Balcon (mortar range), Isla Culebrita (strafing range and torpedo range), and Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Gayos Genequi, Cayo Lobo, and Cayo Alcarraza (all aerial bombardment sites).

3.0.03 Environmental Science and Engineering, Inc. (ESE) conducted an Engineering Evaluation / Cost Analysis (EE/CA) investigation of these sites in October 1995. The EE/CA investigation was performed in accordance with DERP-FUDS; the National Oil and Hazardous Substances Pollution Contingency Plan, commonly called the National Contingency Plan; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly called Superfund; and relevant United States Army regulations and guidance for ordnance and explosive waste programs. In the EE/CA Report (ESE 1996), ESE characterized the type of ordnance found and assessed the exposure potential at each of the sites based on the statistical sampling of randomly placed grids at each of the 11 sites. ESE then evaluated several remedial action alternatives based on the nine CERCLA evaluation criteria.

3.0.04 ESE identified five separate ordnance operational units (OOUs) based on location, previous land use, and similar geographical characteristics. The selected remedial alternatives included clearance for use at Flamenco Beach (OOU-1) and the Northwest Peninsula (OOU-2), and surface clearance of MEC and munitions constituents (MC) at Cerro Balcon (OOU-3), Isla Culebrita (OOU-4), and the adjacent cays (OOU-5), including Cayo Botela, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Genequi, Cayo Lobo, and Cayo Alcarraza. An EE/CA Action Memorandum (ESE 1997) was filed which identified clean-up options and was approved by DoD.

3.0.05 This Non-Time-Critical Removal Action Plan is created to implement the surface removal actions presently approved at Cerro Balcon, Isla Culebrita, Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Gayos Genequi, Cayo Lobo, and Cayo Alcarraza.

3.0.06 Subsequently, USACE St Louis District was enlisted by USACE Jacksonville District (CESAJ) to conduct further archive searches to supplement the data from the initial ASR. The supplemental ASR adds to the findings of the original ASR prepared by USACE in February 1995 (USACE 2004) and identified additional areas of potential concern for Culebra and the adjacent cays. The data from these findings will be the basis of future investigations and removal actions.

4.0 Facility Profiles

4.0.01 Gun ships and carriers of the United States Navy and Marines and the North Atlantic Treaty Organization used the former Culebra Island naval facility on Culebra Island, Puerto Rico, for training. Facilities constructed by the Navy included a desalination plant, an airfield, barracks, helicopter pads, range instrumentation facilities, gun sites (for the defense of the islands), observation points, and impact ranges for aerial bombs and rockets, missiles, mortars, and naval ordnance.

4.0.02 Culebra Island and adjacent cays were used as an impact range for aerial bombs and rockets, missiles, mortars, and naval projectiles from 1903 until 1975. The Marines used Culebra Island as a training facility from 1903 until 1941, during which time a rifle range was constructed at the airfield site. The United States Caribbean fleet used Culebra Island and the adjacent cays for naval exercises throughout its history. A large fleet exercise was conducted from December 1923 through February 1924. Approximately 3,300 Marines participated in the maneuvers armed with 155-millimeter (mm) guns, 75 mm guns, and machine guns. Another fleet exercise was conducted from January through March 1935.

4.0.03 The December 1923 through February 1924 exercise involved the 5th Marine Corps Regiment, which included a "gas platoon." This is the only indication of the possible presence of chemical warfare material (CWM).

4.0.04 The Navy abandoned the lower camp area in 1920. This area was re-activated in 1942 before its reduction to caretaker status in 1944. Culebra Island was used as a bombing and gunnery range from 1935 through 1975. The Cerro Balcon area was used as a mortar range. Naval records indicate bombardment of Flamenco Peninsula in 1936 and again in 1949.

4.0.05 The Navy also conducted submarine warfare maneuvers. Fourteen live torpedoes were fired at Cayos Geniqui in November 1959, and other records indicate that submarines also fired torpedoes at Marcs Point on Isla Culebrita. The firing of torpedoes within the area of Culebra and the adjacent cays ceased prior to 1969.

4.0.06 Until the early 1960s, Flamenco Peninsula, Los Gemelos, and Alcarraza were the only aircraft targets in the complex. To support increased training needs during Vietnam operations, the Navy acquired additional training areas on cays east and west of Culebra Island for use as aircraft ranges.

4.0.07 In 1964, the target range was expanded to the eastern and western cays. Aerial mining operations were also conducted in these outlying areas. Live ordnance operations reached their peak in 1969, when the fleet was training pilots for Vietnam. Aircraft bombing and strafing of Flamenco Peninsula ended in 1970, and the use of live rounds for naval gunfire support training ended in 1971. Subsequent naval support training was conducted using quarter puff rounds until ordnance use was terminated on September 30, 1975.

5.0 Physical Profiles

5.0.01 Culebra Island and the adjacent cays (7,300 acres) have sandy beaches, irregular rugged coastlines, lagoons, coastal wetlands, steep mountains, and narrow valleys. Ninety percent of the island is mountainous, with population concentrations in the flatlands. The highest point on Culebra Island is Monte Resaca, which is approximately 630 feet above mean sea level. The second highest point is Cerro Balcon at 511 feet above mean sea level. The island has a limited variety of soil types, due to its volcanic origin, limited size, rugged terrain, and moderately uniform climate. Most soils, except along the slopes, are the result of weathering bedrock. The

Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate.

5.0.02 Fresh water is scarce on the island, and it is high in chloride and saline. Most residents get their water from a desalination plant installed by the Navy at the lower camp and from a water line from the Island of Puerto Rico. There are some shallow (10 to 20 feet deep) wells in areas away from coastal seepage, but these wells are high in chloride concentrations and salinity. Surface water is also scarce, and creeks and streams are intermittent and seasonal. Normally they are dry and only collect and drain runoff water during rainstorms. Approximately 12 natural springs and seeps exist, but they are charged only during particularly wet seasons (USACE-RI 1995).

5.0.03 Due to the shallow bedrock and impermeability of the lava and overlying soil, the potential for use of groundwater as potable domestic, municipal, or commercial water source is virtually nonexistent. No significant aquifers are on Culebra Island and the adjacent cays.

5.0.04 The National Oceanic and Atmospheric Administration (NOAA) estimates that water depths average approximately 70 to 90 feet in the areas adjacent Culebra Island; however, some areas west of Flamenco Peninsula and east of Cayos Geniqui are more than 130 feet deep. Local charts show "Caution UXO [unexploded ordnance]" in the northern and western areas. Tidal data for Culebra Island indicates that tides are chiefly diurnal. The height difference between mean higher high water and mean lower low water is 1.1 feet. The mean tide level is 0.6 foot.

5.0.05 Puerto Rico and its outlying islands are part of an island arc that largely consists of faulted and folded vulcaniclastic and sedimentary rock, locally intruded by igneous rock. These rocks range from Cretaceous to Eocene in age (USGS 1999).

5.0.06 Andesite lava and andesite tuff are clearly dominant igneous rocks found in the archipelago. Toward the north-central part of Culebra and on eastern Cayo Luis Pena, the tuff and lava contain diorite porphyry inclusions. These volcanic rocks no longer exhibit porosity, due to compaction and the filling of pores with quartz and calcite (USACE-RI 1995). A map showing the geology of Culebra Island and the adjacent cays is included in Appendix B of the Work Plan.

6.0 Release Profiles

6.0.01 In general, chemical contaminants from ordnance impacts and detonations are located in the soils nearby the impact craters and thereby create an extremely heterogeneous distribution rather than widespread homogenous contamination. The major source zones for residues of high explosives reside either near targets or in the immediate vicinity of munitions that have undergone low order (partial) detonations or that have ruptured upon impact (Jenkins et al. 1997).

6.0.02 Previous soil samples have not been collected at the Cerro Balcon site or on the cays. EEG previously collected soil samples for explosives and Resource Conservation and Recovery Act (RCRA) metals and explosives components at the Northwest Peninsula. Results of the chemical analyses of background surface soil and surface soils collected prior to demolition of unexploded ordnance (UXO) indicated that explosive residues and metals were not found at detectable levels. Post-detonation samples from a demolition pit showed detectable quantities of TNT and a couple of the dinitrotoluene compounds in a few cases. Post-detonation samples collected in the crater of a 250- and a 500-pound bomb showed no detectable quantities of explosive compounds (EEG 2004).

6.0.03 "UXO can exist on firing ranges in a number of physical states that greatly affect the fate and transport of explosives contained in the UXO. Intact delivery systems may occur at the firing range from either deliberate burial or fired munitions that failed to detonate. Explosives contamination from intact delivery systems results from corrosion and development of pinhole cracks that may occur over time or leaking through screw threads linking the fuse assembly to the main charge. Incomplete detonation or breakup of the delivery system without detonation may also occur, leading to the survival of part or the entire explosive. This explosive may be scattered over the firing range as free product or partially encased in the remains of the delivery system. This results in a complex source term that is not amenable to simple evaluation. Rather than the soil and water concentration being the source, as in manufacturing and packing operations, the source term is a function of the flux of explosives from the exposed surface area of free product in addition to the mobilization of soil explosives" (Brannon et al. 1999).

6.0.04 Explosives contained within UXO are usually in solid form, which remains relatively immobile until dissolution occurs. The dissolution process, in conjunction with the surface area of exposed explosive and the moisture regime to which the UXO is subjected, governs the movement of explosives from the UXO and into the surrounding environment (Brannon et al. 1999). Once dissolution occurs, important fate and transport mechanisms may include advection, dispersion, adsorption/desorption, diffusion, biotic transformation, photolysis, oxidation/reduction, polymerization, covalent binding, infiltration, evapotranspiration, and plant root uptake (Brannon et al. 1999).

6.0.05 Potential environmental pathways for munitions contaminants include groundwater, surface water, soil and sediment, and volatilization of contaminants or contaminants entrained in ambient air. In addition, bioaccumulation of contaminants in fish, waterfowl, wildlife or livestock, and wild plants and commercial agricultural products may be another environmental pathway.

6.0.06 “Potential human exposures to contaminants include ingestion of and direct contact with groundwater, surface water, soil, and possible ingestion of bioaccumulated contaminants in the food chain. In addition, inhalation of volatilized contaminants or contaminants entrained in air is another potential source for human exposure” (Lynch 2002).

6.0.07 During MEC clearance operations, all detonations are expected to go high order so that explosive compounds are completely destroyed. Emissions from efficient detonation of explosives would primarily include NO_x, CO_2, CO, H_2O, and elemental carbon (soot). CO_2, CO, and NO_x produced by the detonation of explosives are dispersed in the atmosphere and are not distinguishable from CO_2, CO, and NO_x produced by other sources. A small fraction of the CO_2, CO, and NO_x produced by the detonation of explosives dissolves in atmospheric moisture and is transported by weather patterns, eventually being deposited on the earth’s surface by precipitation. CO_2 is considered harmless in the open atmosphere. The production of CO_2, CO, and NO_x by aircraft and land-based vehicles is significantly greater than their production by detonation of small amounts of explosives. CO_2, CO, and NO_x produced by the detonations would have no significant environmental impact to ecological receptors. Open detonations would also release small quantities of Toxic Release Inventory chemicals. Research on emission factors of military explosives indicates that for each pound of explosive detonated, only a few ten-thousandths to a few millionths of a pound of each chemical compound is released to the atmosphere in open detonation (Mitchell and Suggs 1998). These small amounts of chemicals would be quickly dispersed in the atmosphere and diluted by oceanic waters.

6.0.08 In the event that energetic materials are not completely detonated, energetic materials may be thrown into the water. The 500-pound bomb explosive is mainly TNT (2,4,6-trinitrotoluene) and the 1,000-pound bomb explosive is H-6 (a binary explosive that is a mixture of RDX, TNT, powered aluminum, and D-2 wax with calcium chloride added).

6.0.09 Most studies of dissolution and degradation processes of explosive compounds have been conducted with respect to developing bioremediation procedures for soils, waste waters, and fresh surface waters and sediments. Very few have dealt with the estuarine or marine environment. The following is primarily from such bioremediation information sources. The same is largely true for the few aquatic toxicological studies found in that they were conducted with the standard Environmental Protection Agency (EPA) freshwater test organisms. A search of TOXNET and IngentaConnect, and ERED revealed very few studies that investigated explosives in the marine environment.

6.0.010 “TNT is unstable under a wide range of environmental conditions, undergoing rapid transformation and binding by soil organic matter. In the presence of soil, mono and diamino reduction products were the primary TNT transformation products (Brannon et al. 1999). As redox potential decreases, TNT disappearance from solution increases. In addition, anaerobic conditions promote the rapid disappearance of certain TNT transformation products and the appearance of others (in particular the diamino products) indicating the progression of the reduction process of TNT from a single nitro group to two” (Price et al. 2000).

6.0.011 Following dissolution and release to surface waters, TNT undergoes rapid photolysis to a number of products. Biodegradation by microorganisms including bacteria and fungi also occurs in surface waters but at rates much slower than photolysis. TNT is not expected to volatilize from surface water to the atmosphere or significantly partition to soils or sediments (ATSDR 1995a). Eventually, transformation of compounds by photolysis and biotransformation is expected to lead to reduced toxicity. Carr (2003) found that biotransformation of 2,6-DNT and picric acid in marine sediments is temperature- and sediment-type-dependent but tends to proceed relatively rapidly and follow the same chemical paths under all tested conditions. Biotransformation in sandy sediments generally took longer than in fine-grained sediments. Whereas some of the major initial biotransformation products of both 2,6-DNT and picric acid were more toxic than the parent compounds in some toxicity assessments, further transformation tended to lead to reduction in toxicity. Toxicity also depended on the taxon, life stage, and exposure.

6.0.012 TNT does not undergo hydrolysis, as demonstrated by the stability of the compound in sea water after 108 days at room temperature. Phototransformation of TNT in surface waters occurs via direct and indirect photolysis. Direct photolysis of the compound is rapid; the estimated half-life varies from 14 to 84 hours, depending on season and latitude. These rates are increased in natural waters through the influence of humic acids on indirect photolysis. In sunlit natural waters, TNT photolysis proceeds at rates 10 to 100 times more rapid than those found in distilled water, with half-lives in some natural waters of less than 0.5 hour. A number of TNT photodecomposition products have been identified, including dinitroanthrils, trinitrobenzaldehyde, trinitrobenzyl alcohol, trinitrobenzene, nitroanilines, condensed azo and azoxy derivatives, and 1,3,5-trinitrobenzene (ATSDR 1995a).

6.0.013 Increases in temperature, interfacial surface area, and energy input via mixing increase the dissolution rates of explosive compounds and explosive formulations (Lynch 2002). Increasing temperature and moisture in a surface soil decreased the stability of 1,3,5-TNB, 1,3-DNB, TNT, 2,4-DNT, and 2,6-DNT (Ravikrishna et al. 2002).

6.0.014 Bioconcentration of TNT by plants and aquatic organisms is limited, and biomagnification of the compound in terrestrial and aquatic food chains is not expected (ATSDR 1995a). Limited bioconcentration was demonstrated in aquatic bioassays with water fleas *(Daphnia magna),* worms *(Lumbriculus variegatus),* algae *(Selenastrum capricornutum),* and bluegill sunfish *(Lepomis macrochirus).* Bioconcentration factors (BCFs) in 96-hour static tests were found to be 209 for the water flea, 202 for the worms, 453 for algae, 9.5 for fish muscle, and 338 for fish viscera (ATSDR 1995a).

6.0.015 Both *Neanthes arenaceodentata* and *Leptochirus plumulosus* were found to be sensitive to the presence of sediment-associated TNT (Green et al. 1999). The 96-h LC_{50} values based on the death response of the fathead minnow to alpha TNT and TNTcc were 2.58 and 1.60 milligrams per liter (mg/L), respectively. The 96-h EC_{50} values based on the behavioral responses were 0.46 and 0.64 mg/L, respectively. There was no response to concentrations of 0.05 mg/L alpha TNT and 0.07 mg/L TNTcc (Smock et al. 1976).

6.0.016 RDX is an explosive nitramine compound, with a nitrogen content of 37.84 percent. The chemical name for RDX is 1,3,5-trinitro-1,3,5-triazine. It is expected that photolysis of RDX is an important fate process in the atmosphere. Hydrolysis is not expected to significantly influence the environmental fate of RDX. The primary physical mechanism that degrades RDX in aqueous solutions is photolysis (ATSDR 1995b). RDX has very low solubility in water and has an extremely low volatility. RDX may not be easily amenable to aerobic biodegradation in soils; however, significant biotransformation may occur under anaerobic conditions.

6.0.017 RDX can be broken down in air and water in a few hours, but breaks down more slowly in soil. When released to water, RDX is subject to photolysis (half-life = 9 to 13 hours). Photolysis of an aqueous solution of RDX in natural sunlight is fairly rapid, with an experimental half-life of 9 to 13 hours. Consequently, RDX is not expected to persist for a long period of time in surface waters (ATSDR 1995b). Photoproducts include formaldehyde and nitrosamines. RDX undergoes biodegradation in water and soil under anaerobic conditions. Its biodegradation products include hexahydro-1-nitroso-3,5-dinitro-1,3,5-triazine; hexahydro-1,3-dinitroso-5-nitro-1,3,5-triazine (DNX); hexahydro-1,3,5-trinitroso-1,3,5-triazine (TNX); hydrazine; l,l-dimethyl-hydrazine, 1,2-dimethyl-hydrazine; formaldehyde; and methanol (ATSDR 1995b). Formaldehyde and nitrosamines were identified as photoproducts. Nitrosamines may be of environmental importance because of their potential mutagenicity/carcinogenicity. Conversion to this product, however, occurs only to a limited extent since the product itself is photoreactive (ATSDR 1995b).

6.0.018 RDX and HMX may pose the more persistent groundwater problem because their mobility is not limited by sorption, degradation, and immobilization as is TNT and its degradation products (Price et al. 2001). The solubility of RDX in water is low to negligible. Soil sorption coefficients are indicative of medium to high mobility in soil; therefore, RDX can be expected to leach into groundwater. Experimental data have shown that RDX is not readily bound or retained in soil. It appears that sorption of RDX in soils is not solely the result of hydrophobic partitioning of RDX to the organic carbon phase of the soils, but is also correlated with clay content, pH, Eh, cation exchange capacity, soil moisture and contact time (ATSDR 1995b, Brannon et al. 1999, Brice et al. 2000). Results of investigations conducted under controlled redox potential and pH conditions indicated that RDX was relatively stable in solution under aerobic conditions. Highly reducing conditions promoted removal of RDX from solution (Price et al. 2001).

6.0.019 RDX can be taken up by plants (ATSDR 1995b). Plants are capable of accumulating TNT and RDX, and partitioning the material itself or its metabolites within tissues consumed by herbivores or humans (Fellows et al. 1995). Assimilated TNT and RDX may have very differing metabolic fates (Fellows et al. 1995, Thorne 1999).

6.0.020 RDX is a not very lipid soluble and therefore has a low potential for bioaccumulation. Experimental BCFs in edible tissue for bluegill (*Lepomis macrochirus*), channel catfish (*Ictalurus punctatus*), and fathead minnow (*Pimephales promelas*) ranged from 1.9 to 6.4, 1.2 to 5.5, and 1.4 to 5.9, respectively. Ocean floor fauna samples (rat tail fish and sea cucumbers) taken from munitions dumping areas in the Atlantic and Pacific oceans contained no RDX residues. These factors indicate that bioaccumulation in aquatic organisms is not an an important fate process (ATSDR 1995b).

6.0.021 White phosphorus is used in ammunitions such as mortar and artillery shells, and grenades. It may also be found at sites where the military uses phosphorus-containing ammunition during training exercises. Rainwater washout of these sites may contaminate nearby waterways and their bottom deposits. Because white phosphorus reacts very quickly with oxygen in the air, it may not be found far away from sources of contamination. White phosphorus vapor in air reacts with oxygen and is changed to relatively harmless chemicals within minutes. White phosphorus reacts mainly with oxygen in water and may stay in water for hours to days. However, chunks of white phosphorus coated with protective layers may stay in water and soil for years if oxygen levels in the water and soil are very low.

6.0.022 In water with low oxygen, white phosphorus may react with water to form a compound called phosphine. Phosphine is a highly toxic gas and quickly moves from water to air. Phosphine in air is changed to less harmful chemicals in less than a day. White phosphorus may stay in soil for a few days before it is changed to less harmful chemicals; however, in deeper soil and the bottom deposits of rivers and lakes where there is no oxygen, white phosphorus may remain for several thousand years. White phosphorus binds moderately to soil and typically does not move deep in soil with oxygen-depleted rainwater. The two processes involved in the transport of elemental phosphorus from soil are volatilization and leaching. White phosphorus moderately bio-concentrates in aquatic organisms (ATSDR 1997).

6.0.023 Perchlorate salts have been widely used as an oxidizer in solid propellants for rockets and missiles since the mid-1940s (CEPA 2004). Large commercial quantities of ammonium perchlorate are used in 1.3-inch-diameter solid rocket motors and to a limited extent in pyrotechnic and explosive compositions. Potassium perchlorate is used extensively in pyrotechnic compositions and in black-powder-substitute gun propellants. It is used in some spotting charges that enable range control personnel to assess the accuracy of inert (nonexplosive) rounds (Thorne 2004). Perchlorate is highly mobile in aqueous systems and can persist for many decades under typical ground and surface water conditions (CEPA 2004).

6.0.024 Tetryl was used as a filler in some 20 mm projectiles used by the Navy. Tetryl is considered essentially non-volatile and it is unlikely that tetryl will partition to air. When released to the atmosphere, tetryl is expected to react and undergo transformation with sunlight and it will be removed from the atmosphere by wet and dry deposition. When released to water, tetryl is subjected to hydrolysis and photolysis, but photolysis will be more important in surface water. Hydrolysis and photolysis products include picrate ion, N-methylpicramide, methylnitramine, nitrite ion, and nitrate ion. Tetryl is not mobile in soil and leaching into groundwater is not likely, especially in soils with a high organic content. Biodegradation studies suggest that tetryl may undergo biotransformation under certain environmental conditions. It is not expected to bioconcentrate, but data are uncertain (ATSDR 1995c).

6.0.025 Picric acid, one of the breakdown products of tetryl, is soluble in water and is expected to leach through soil to groundwater in substantial amounts. It is expected to dissociate in water, especially when present in low concentrations. Picric acid may also form complexes with metal ions in soil, causing some of the chemical to remain bound. Picric acid that is bound to soil may be transformed via photolysis if present at the soil surface (ATSDR 1995c).

7.0 Land Use and Exposure Profiles

7.1 Cerro Balcon

7.1.01 Cerro Balcon is located on Culebra Island approximately 2.5 miles from the former Lower Camp. The base of Cerro Balcon was used as a mortar range, with the firing point located less than 1 mile from the impact area. The mortar range was used in the 1930s with the entire range fan comprising approximately 48 acres. The main impact area was approximately 6 acres. Probably very few people visit this site per year based on the fact that this site is remote and privately owned.

7.1.02 The Cerro Balcon project area is utilized in part as pasture land. The land is fenced and gated along the public road to the west. Livestock can still be seen foraging in the area. The slopes of the mountain and adjacent hills are heavily vegetated with shrubs, trees, and grasses.

7.1.03 An unfinished residence currently exists at the summit of Cerro Balcon and overlooks the project site, and a new residence has been constructed just adjacent to the site. It is anticipated that the Cerro Balcon area will be further developed as residential lots are currently being offered for sale.

7.2 Isla Culebrita

7.2.01 Isla Culebrita comprises approximately 366 acres and is approximately 1 mile east of Culebra Island. Isla Culebrita is administered by FWS. The island can be reached only by boat and is a popular destination for outdoor activities, particularly water-related recreation. According to FWS, more than 20,000 visitors per year visit Isla Culebrita to hike, sunbathe on the beaches, dive, and snorkel. The north bay of Isla Culebrita is a popular area for boaters and beach visitors.

7.2.02 No facilities exist on the island, although there are some foot paths used by island visitors. An historic lighthouse exists on the island. It is anticipated that FWS will further develop the island with additional hiking trails (Felix Lopez, personal communication).

7.2.03 Several tour guides are permitted access to the island. Most tour guides drop off visitors on the south shore of Isla Culebrita and the visitors hike to North Bay. The shoreline on the south is deeper and less dangerous for boat operations than the shallower North Bay. The east and west sides of the island are difficult to access due to broad shallow reefs and rocky shores.

7.2.04 Threatened or endangered species of sea turtles commonly nest on the sandy beaches and forage in sea grass beds. During the nesting season, nesting beaches are patrolled by FWS or by contracted personnel. Volunteers may also be involved in turtle nesting surveys.

7.3 Additional Cays

7.3.1 Cayo Botella

7.3.1.01 Cayo Botella is located approximately ¾ mile east of Culebra Island. It is a small cay of approximately 3.5 acres in size with mostly rocky shores and light vegetation. This cay was used as a bombing range and for aerial rockets. A large bullseye was painted on the ground with lime to act as a target for pilots.

7.3.1.02 Cayo Botella is administered by FWS. Based on data from FWS, approximately 50 people per year visit this cay, mostly illegally (without permits from FWS). Scuba divers commonly visit the underwater reefs around this cay. Nesting birds and turtles do not frequent this cay, and it is fairly inaccessible by water during most of the year due to the rocky shores and shallow reefs.

7.3.2 Cayos Geniqui

7.3.2.01 Cayos Geniqui are located approximately 1.25 miles northeast of Culebra Island. Cayos Geniqui consists of two very small cays of approximately 4 total acres, with steep rocky shores and light vegetation. These cays were used for aerial bombing and for aerial rockets. The Navy also used these cays as torpedo targets.

7.3.2.02 Cayos Geniqui are administered by FWS. Based on data from FWS, approximately 50 people per year visit this cay, including illegal poachers who steal the eggs of nesting birds. Access onto Cayos Geniqui is difficult due to the rocky shores and shallow reefs. Only experienced boaters will attempt to transport people to these cays and only in the calmest sea conditions. FWS personnel visit these cays at least four times a year to observe nesting activities of migratory birds.

7.3.2.03 Cayos Geniqui are also a common nesting area for several bird populations. Brown noddies, laughing gulls, Audubon's shearwaters, red-billed tropic birds, brown boobies, and red-footed boobies are the most common nesting birds on Cayos Geniqui.

7.3.3 Cayo Tiburon

7.3.3.01 Cayo Tiburon is located approximately 1.25 miles northeast of Culebra Island. It is approximately 1 acre, with steep, rocky shores and light vegetation. This cay was used for aerial bombing and for aerial rockets.

7.3.3.02 Cayo Tiburon is administered by FWS. Due to the size, people do not visit this cay. Access is difficult due to the rocky shores and shallow reefs. Only experienced boaters will attempt to transport people to this cay and only in the calmest sea conditions.

7.3.3.03 This cay may be a common roosting area for several bird populations. FWS personnel visit this cay at least four times a year to observe nesting activities of migratory birds. They generally do not land on this cay.

7.3.4 Cayo del Agua

7.3.4.01 Cayo del Agua is located approximately 1.5 miles southwest of Culebra Island. It is approximately 2 acres and has steep, rocky shores and light vegetation. This cay was used for aerial bombing and rockets.

7.3.4.02 Cayo del Agua is part of the Three Brothers (Los Hermanos) chain, which also includes Cayo Yerba and Cayo Raton. Even though there is no mention of ordnance at the latter two cays, local divers have indicated the possibility of underwater ordnance near these cays.

7.3.4.03 Cayo del Agua is administered by FWS. Access is difficult due to the rocky shores and shallow reefs. Based on data from FWS, approximately 250 people per year visit this cay, including illegal poachers who steal the eggs of nesting birds.

7.3.4.04 This cay is a common nesting area for several bird populations. According to FWS, the most important bird populations on Cayo del Agua are the bridled tern, Zenaida doves, Audubon's shearwaters, and red-billed tropic birds. FWS personnel visit this cay at least four times a year to observe nesting activities of migratory birds.

7.3.5 Cayo Lobo

7.3.5.01 Cayo Lobo is located approximately 2.5 miles southwest of Culebra Island. It is approximately 20 acres and has steep, rocky shores and some sandy beach access. Tall grasses and thorny brush cover most of this cay. It was used for aerial bombing and for aerial rockets. In later years, observation posts were constructed to observe activities on Cayo del Agua and Los Hermanos as well as to observe activities on Cayo Lobo itself.

7.3.5.02 Cayo Lobo is administered by FWS. This cay is not very popular, as it is overrun with rats, which devour the eggs of nesting birds. As a result, no significant nesting bird populations occur on this cay. Access onto Cayo Lobo is difficult due to the rocky shores and shallow reefs. FWS personnel visit this cay only once or twice a year. Based on data from FWS, estimates of approximately 200 people per year visit this cay, mostly illegally.

7.3.6 Cayo Alcarraza

7.3.6.01 Cayo Alcarraza is located approximately 2 miles northwest of Culebra Island. It is approximately 7 acres and has very steep, rocky shores and light vegetation. This cay was used for aerial bombing and for aerial rockets. Local divers report that they have seen torpedoes underwater at Alcarraza

7.3.6.02 Cayo Alcarraza is administered and access is regulated by the FWS. Approximately 25 people per year visit this cay; including illegal poachers who steal the eggs of nesting birds. Access onto Cayo Alcarraza is difficult due to the rocky shores, steep cliffs, and shallow reefs. Only experienced boat operators can access this cay, and only during calm sea conditions.

7.3.6.03 This cay is a common nesting area for several bird populations. FWS personnel visit this cay at least four times a year to observe nesting activities of migratory birds. According to FWS, Cayo Alcarraza may have populations of nesting bridled terns, brown noddies, Audubon's shearwaters, red-billed tropic birds, and masked boobies.

7.3.7 Los Gemelos

7.3.7.01 Los Gemelos is located approximately 1.5 miles northwest of Culebra Island. Los Gemelos comprises approximately 2 acres and has very steep, rocky shores and light vegetation.

This cay was used for aerial bombing, rockets, and missiles. Most of the 2 acres used for bombing is at or below the surf zone.

7.3.7.02 Los Gemelos is administered by FWS. Based on the size of the cay and data from FWS, this cay is not visited by people. Access onto Los Gemelos is difficult due to the rocky shores, steep cliffs, and shallow reefs. Experienced boat operators have difficulty accessing this cay. This cay is a roosting area for occasional bird populations and is monitored for roosting birds by FWS. The rocks are easily swept by north swells.

8.0 Ecological Profiles

8.1 Endangered or Threatened Species

Endangered and threatened plants and animal species inhabit specific areas of the Culebra Archipelago. The known endangered and threatened species that may be located in the area are listed in the Environmental Protection Plan.

8.1.1 Additional Cays

8.1.1.01 The cays adjacent to Culebra are known as nesting areas for shore birds, seabirds, and sea turtles. Although seabirds may be present on the cays year round, the majority of shore bird and seabird nesting occurs during the spring and summer months. Off-shore keys provide a variety of habitat types for migratory seabirds, including laughing gulls; sooty, roseate, and bridled terns; white-tailed and red-billed tropicbirds; and brown noddies. Throughout the year, three species of boobies, magnificent frigate birds, brown pelicans, and royal terns are found in remote areas of the archipelago (http://www.fws.gov/southeast/culebra/index.html). An environmental sensitivity index map is provided in Appendix B of the Work Plan. The map provides habitat types and known locations of wildlife occurrences.

8.1.1.02 The volcanic rocks and cays of northeastern Puerto Rico provide a suitable habitat for the nesting of marine birds. These rocks and cays are unstable and subject to erosion despite their dense vegetative cover. Fourteen species of marine birds nest in the Culebra archipelago (Saliva 2005) (see following table). On the Island of Culebra and on Cayo Yerba, Saliva and Burger (1989) found that sooty terns selected nest sites that had taller vegetation and more cover over the nest and that were farther from open areas.

Nesting Marine Birds of the Culebra Archipelago

Latin Name	Spanish Common Name	English Common Name
Anous stolidus	Cervera	Brown noddy
Larus atricilla	Gaviota cabecinegra	Laughing gull
Phaethon aethereus	Chirre de pico colorado	Red-billed tropicbird
Phaethon lepturus	Chirre de cola blanca	White-tailed tropicbird
Puffinus lherminieri	Pampero	Audobon’s shearwater
Sterna anaethetus	Gaviota monja	Bridled tern
Sterna dougalli	Palometa	Roseate tern
Sterna eurygnatha	Gaviota de cayena	Cayenne tern
Sterna fuscata	Gaviota oscura	Sooty tern
Sterna maxima	Gaviota real	Royal tern
Sterna sandvicensis	Gaviota piquiaguda	Sandwich tern
Sula dactylatra	Boba enmascarada	Masked booby
Sula leucogaster	Boba parda	Brown booby
Sula sula	Boba patirroja	Red-footed booby
Source: Saliva 2005		

8.1.1.03 Roseate tern (palometa), a threatened species, arrives at the end of April and begins nesting in the middle of May. Nesting areas may be moved from year to year. If reproduction is successful, juveniles and adults leave Culebra at the end of July or early August. Nesting pairs of roseate tern have continually declined from 300 in 1988 to 15 to 25 in the 1990s. Population estimates in 2000 and 2004 indicated no more than 15 pairs (Saliva 2005). Roseate terns usually hide their nests under some sort of protective cover such as rocks, vegetation, or washed-up debris (Spendelow 1995). Caribbean birds use a variety of substrates, including open sand and coral rubble, rocky cliffs, and low islands. Nesting sites may be densely vegetated or bare. Varying amounts of debris and vegetation may be present in the nesting area.

8.1.1.04 The National Marine Fisheries Service (NMFS) (FR Vol. 63, No.170, September 2, 1997) designated critical habitat pursuant to the Endangered Species Act of 1973 (ESA) for the threatened green turtle (*Chelonia mydas*) to include waters extending seaward 3 nautical miles (5.6 kilometers) from the mean high water line of Culebra Island. These waters include Culebra’s outlying cays, including Cayo Norte, Cayo Ballena, Cayos Geniqui, Isla Culebrita, Arrecife Culebrita, Cayo de Luis Pena, Las Hermanas, El Mono, Cayo Lobo, Cayo Lobito, Cayo

Botijuela, Alcarraza, Los Gemelos, and Piedra Steven. The extensive seagrass beds of the Culebra archipelago support a large juvenile population of green turtles.

8.1.1.05 On November 10, 1993, FWS designated Culebra seagrass beds as Resource Category 1, recognizing these seagrasses as critical foraging habitat for juvenile green turtles. Resource Category 1 designation recognizes the habitat as unique and irreplaceable on a national or ecoregional level and states that loss of the habitat is not acceptable. The seagrass beds of Culebra consist primarily of turtle grass (*Thalassia testudinum*). In the Caribbean, turtle grass beds consist primarily of turtle grass but may include other species of seagrass such as manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), and sea vine (*Halophila decipiens*), as well as several species of algae including green algae of the genera *Halimeda, Caulerpa,* and *Udotea.*

8.1.1.06 The additional smaller cays are generally surrounded by coral habitat (see **Figures I-1 through I-4**). Garcia-Sais et al. (2001) provided a description of reefs of the Cordillera de Fajardo Natural Reserve that lies between Culebra and Fajardo, Puerto Rico. “Rock reefs” are the most abundant and prominent formation within reserve boundaries. These are mostly found on the windward side of islets and thereby exposed to very high wave action, particularly during the winter. Biological assemblages are generally limited to encrusting biota (including corals), with low vertical relief and providing only a minor contribution to the physical structure of the reef. “Patch reefs” are generally small, submerged reef structures surrounded by a sandy substrate, sometimes consisting of only one large coral colony. Patch reefs are common along the leeward side of the larger islets. Coral reefs are best developed as “fringing reefs” on the leeward (protected) section of the chain of islets at the northern boundary of the reserve. Turf algae habitat generally dominates percent cover estimates of the benthic habitat (Garcia-Sais et al. 2005, 2001). This appears to correspond with the colonized pavement habitat classification of NOAA (2001).

8.1.1.07 (NMFS has proposed that elkhorn (*Acropora palmata*) and staghorn (*A. cervicornis*) corals be listed as threatened under the ESA (FR Vol. 70, No. 88:24359, May 9, 2005). Staghorn coral is a branching coral with cylindrical branches ranging from a few centimeters to over two meters in length and height. It occurs in back reef and fore reef environments from 0 to 30 meters depth. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Although *A. cervicornis* colonies are sometimes found interspersed among colonies of *A. palmata*, they are generally in more protected, deeper water or seaward of the *A. palmata* zone and hence protected from waves (*Acropora* BRT 2005). Fore reef zones at intermediate depths (5 to 25 meters) were formerly dominated by extensive single species stands of staghorn coral until the mid-1980s. Elkhorn coral is a large branching coral with exceptionally thick and sturdy antler-like branches forming extensive, densely aggregated thickets (stands) in areas of heavy surf. Colonies prefer exposed reef crest and fore reef environments in depths of less than 6 meters, although isolated corals may occur to 20 meters. The preferred habitat of *A. palmata* is the seaward face of a reef (turbulent shallow water), including the reef crest, and shallow spur and groove zone (*Acropora* BRT 2005).

8.1.1.08 Both elkhorn and staghorn corals underwent precipitous declines in abundance in the early 1980s throughout their range, and this decline has continued. The major threats to the existence of these corals are disease, elevated temperature, and hurricanes. Disease was identified as the single largest cause of both elkhorn and staghorn coral mortality and decline. Hurricanes appear to be the main factor for the large-scale decimation of elkhorn coral (*A. palmata*) biotopes in Puertorrican reefs (Garcia-Sais et al. 2005). Less severe stressors include anchoring and subsequent breakage of corals. Their branching morphology makes them particularly susceptible to breakage. The creation of fragments through breakage is a natural means of asexual reproduction for these species; however, the fragments must encounter suitable habitat to be able to reattach and create a new colony (FR Vol. 70, No. 88:24359, May 9, 2005).

8.1.2 Isla Culebrita

8.1.2.01 The strafing fire range on Culebrita is approximately 82 acres in size and located on the northwest portion of the island. A portion of the range enters the water near the north beach.

8.1.2.02 The upper elevations of the strafing range are characterized by a cactus-thorn scrub or coastal thicket habitat. The sides of the range are characterized by rock pavement/sea cliff habitat. Salt ponds exist toward the northern and southern portions of the strafing range. Shoreline vegetation along the Playa Tortuga is largely sea grape and grasses. Culebrita has flora and fauna that have become quite rare in the Caribbean (Tippetts-Abbett-McCarthy-Stratton 1973).

8.1.2.03 Nesting hawksbill sea turtles prefer low-energy sandy beaches with woody vegetation such as sea grape or saltshrub located within a few meters of the water line. Suitable nesting habitat can be extremely variable and ranges from high-energy ocean beaches to tiny pocket beaches only a few meters in width. Nests are typically placed under vegetation (NMFS/FWS 1993). The nesting season varies with locality, but in most locations nesting occurs some time between April and November. Hawksbills nest at night and, on average, about 4.5

times per season at intervals of approximately 14 days. On Isla Culebrita, all beachfront areas on the southwest-facing shore, east-facing shore, and northwest-facing shore of the island from mean high tide inland to a point 150 meters from shore have been designated critical habitat for hawksbill sea turtles (50 CFR 17.95).

8.1.2.04 The largest concentration of nesting leatherback sea turtles in the United States Caribbean has been documented at Sandy Point National Wildlife Refuge, St. Croix, and Playa Brava and Playa Resaca on Culebra Island. Nesting females prefer high-energy beaches with deep and unobstructed access. The Island of Culebra and St. Croix beaches have the greatest density of leatherback nests within United States waters. In the wider Caribbean, major nesting commences in March (a few nests may be laid from December to February) and continues into July (NMFS/FWS 1992). On Culebra, the nesting season begins in February and continues through July. Hatching may begin as early as April and continues through September. Leatherbacks nest in sand near the vegetation line on the beach (http://www.coralations.org/turtles/index.htm). Atlantic leatherbacks nest an average of six times from March to July, with approximately 10 days between the nesting episodes. Often turtles will lay their nests in areas that are under water during high tide.

8.1.2.05 In the Atlantic, leatherbacks nest from November to April (http://www.speciesatrisk.gc.ca/search/speciesDetails_e.cfm?SpeciesID=274). In St. Croix, the nesting period extends from February 9 to August 11, with each turtle laying an average of 5.26 nests per season with an inter-nesting interval of 9.6 days (Boulon et al. 1996).

8.1.2.06 The red-billed tropic bird nests on Isla Culebrita. Cactus scrub associations support diverse bird and reptile species (http://www.fws.gov/southeast/culebra/index.html). Brackish lagoons and salt ponds fluctuate with rainfall and tides and are important sites for waterfowl and shorebirds, especially during winter months. Lagoons are located on the northwest portion of Isla Culebrita within the strafing range project area. Saline ponds and lagoons are particularly important to migratory waterfowl such as blue-winged teal, as well as the resident white-cheeked pintail and several waders. The usual fringe of mangroves surrounding these saltwater ponds provides habitat for nesting populations of herons, pigeons, and many songbirds (http://biology.usgs. gov/s+t/SNT/noframe/cr133.htm).

8.1.2.07 The Atlantic Coast piping plover (*Charadrius melodus*) population breeds on coastal beaches from Newfoundland to North Carolina (and occasionally in South Carolina). The piping plover's winter range extends along the Atlantic and Gulf coasts from North Carolina to Mexico and into the Bahamas and West Indies (FWS 1996). Plovers appear to prefer sandflats adjacent to inlets or passes, sandy mudflats along prograding spits, and overwash areas as foraging habitats (FWS 1996, 50 CFR 17).

8.1.2.08 Benthic habitats surrounding Isla Culebrita include corals and seagrass beds (see **Figure I-1**).

8.1.3 Cerro Balcon

8.1.3.01 The Cerro Balcon project site is located on private land in the interior of the Island of Culebra. Historic land use during the period of operations as a mortar range was generally pasture land (USACE 2004). Currently the lower land elevations appear relatively fallow, with portions of the site colonized in guinea grass (*Panicum maximum*) and portions of the site overgrown in thorny shrubs/trees. Within the thorny scrub, a relatively high density of tarantula (*Cyrtopholis* spp.?) burrows and cacti (*Opuntia* spp.) are evident. In general, historic pasture land on Culebra that has remained fallow has been colonized by invasive plant species such as casha (*Acacia* spp.) and mesquite (*Prosopis glandulosa*). Both may be heavily grazed by goats. Three farm ponds are located between 1,600 and 3,500 feet downslope from the project site.

8.1.3.02 No known threatened or endangered species occur on the project site, but the potential exists for occurrence of some species such as the Culebra Island giant anole on mountain slopes, or occasional waterfowl or wading birds in the farm ponds. The anole has not been seen since the 1930s. Goats and other livestock at the project site may represent a significant source of environmental disturbance to vegetation and soils.

9.0 Pathway Analysis

Physical site features that may influence receptor exposure include geology, hydrogeology, climate, meteorology, vegetation, and soil type. A complete exposure pathway consists of the following elements: source and mechanism of chemical release, intermediate transport mechanisms, migration pathways, receptors, and exposure routes.

9.1 Cerro Balcon

9.1.01 **Figure I-5** presents the CSM for the Cerro Balcon site. The site is predominantly agricultural but is slated for future development, particularly on the higher elevations with a view. A couple of new residences have been constructed atop surrounding hills. An approved residential project has been held up due to ordnance related issues (Yarissa Martinez and Felix Lopez, personal communication).

9.1.02 The Cerro Balcon mortar range is in the east central section of Culebra Island. The firing point was located approximately 0.5 mile north-northeast of the former Lower Camp. The 1995 ASR reported possible Stokes mortar fragment observed on this site. The entire range fan, as drawn in the 1995 ASR, encompasses an area of approximately 158 acres, including Cerro Balcon. The range fan is drawn past the top of Cerro Balcon, but it is most likely that the impact area was at the base of the hill. The 2005 supplemental ASR indicated that the mortar range was included in a larger combat training range.

9.1.03 The Cerro Balcon site was used principally as a mortar range that included the use of both practice and HE rounds. No UXO were found at Cerro Balcon during the 1995 EE/CA sampling. Nineteen pieces of ordnance-related scrap were recovered, leading to the possibility that UXO remains and the possibility that energetic materials entered the environment. Mortar fragments from several mortar types were found off the grid, including 81 mm Stokes mortars and possible 4-deuce mortar fragments. Most of the mortar fragments found at the impact area would not have the distance capability to go over Cerro Balcon, with the exception of the 4-deuce mortars. No soil samples have been collected with which to determine a mean concentration of potential chemical contaminants and a potential exposure concentration term.

9.1.04 Since the time when the site was used as a mortar range, the area has become heavily vegetated with grasses and shrubs and trees, leading to the possibility that surface ordnance has become buried. The most likely potential future exposure to UXO would be direct contact by a construction worker involved in ground-clearing or intrusive activities associated with residential development. Potential exposure to energetic materials would be through direct contact with or incidental ingestion of soils.

9.1.05 As the area is relatively arid and the soil layer is thin, the probability of exposure through contact with groundwater or leaching of groundwater off site seems relatively low. Groundwater in the area is not used as a potable water source. It is estimated that only about 1 inch of rainfall a year actually infiltrates to replenish groundwater (DOI 1973). Most surficial groundwater is probably utilized by site vegetation, and over the past 65 to 70 years any energetic materials that may have been released to soils and surficial water may have been naturally phytoremediated. The pathway of groundwater to marine surface water from Cerro Balcon is likely not complete given the interior island site location, the shallow depth to bedrock, the arid climate and high evapotranspiration rates, and drainage downslope toward the farm ponds.

9.2 Isla Culebrita

9.2.01 **Figure I-6** presents the CSM for the Isla Culebrita site. Strafing activity on Isla Culebrita was confined to an 82-acre strafing range located on the northwestern end of the island. During the 1995 EE/CA sampling in six grids in this area, 39 UXO and 26 munitions debris items were found. Sampling of the strafing range recovered only 20 mm projectiles. Many of these projectiles contained high-explosive incendiary fill. All were recovered from a depth of less than 6 inches. No soil samples have been collected with which to determine a mean concentration of potential chemical contaminants and a potential exposure concentration term. There is no evidence of activities that indicate the presence of UXO items in the area outside the firing range.

9.2.02 The upper elevations of the strafing range are relatively inaccessible due to thick, thorny vegetation and rocky shorelines, and are not likely to be accessed by island visitors. The most likely potential exposure to UXO or contaminated soils would be by FWS site workers clearing hiking trails or conducting ecological surveys.

9.2.03 The soils of Culebra consist of a thin layer only a few feet thick atop the bedrock; therefore, transport of contaminants via groundwater flow and discharge to surface waters does not seem highly probable. As this is a relatively arid environment, evaporation rates are high; most surface water is likely utilized by the vegetation. Surface runoff of soils may occur around the margins of the range bordered by rocky cliffs.

9.2.04 Nesting birds may be potentially exposed to energetic materials and their breakdown products via incidental ingestion of site soils during nesting activities. As seabirds are marine foragers, exposure to energetic materials through ingestion of food items would not be expected. As discussed above, these energetic materials appear to have low potential to bioaccumulate.

9.2.05 There may be some minimal adverse and localized impacts to corals or other marine organisms if sand bags, ordnance fragments, or undetonated explosive compounds are thrown into the water; however, these would be one-time events and the amounts of any fragments or explosives would be minimal and dispersed. Dissolution and dispersion of energetic materials would be relatively rapid due to ocean dynamics.

9.2.06 Energetic materials deposited in the surrounding ocean waters would be expected to undergo rapid dissolution and dispersion as a result of ocean water column and sediment dynamics. As the waters in the project area are clear and warm, one would expect that photolysis rates would be relatively high and subsequent half-lives relatively short. One would also expect that, although largely unstudied, marine bacteria and other microorganisms would play roles in the biotransformation of energetic materials to compounds of reduced to no toxicity. Because of the initial small quantities of energetic materials that could potentially be ejected and the large-scale oceanic mixing and dispersion dynamics, it is unlikely that concentrations near EC_{50} or LC_{50} determined in laboratory toxicology studies would be achieved. Additionally, these would be one-time events of short duration.

9.3 Additional Cays

9.3.01 No soil samples have been collected with which to determine a mean concentration of potential chemical contaminants and a potential exposure concentration term. The CSM for the additional cays will be the same as that for Isla Culebrita. Potential human exposure to UXO would be more limited as visitors do not heavily frequent the cays. Potential exposure to UXO would be highest for FWS personnel conducting ecological surveys or for trespassers.

9.3.02 Soils and vegetation are more limited on the cays, and certain cays are merely rocks. These rocks and cays are unstable and subject to erosion despite their dense vegetative cover (Saliva 2005).The groundwater pathway is likely not a complete exposure pathway on the smaller cays. Runoff of surface soils to the nearby marine waters may represent a complete exposure pathway for marine receptor species.

9.3.03 Energetic materials deposited in the surrounding ocean waters would be expected to undergo rapid dissolution and dispersion as a result of ocean water column and sediment dynamics. As the waters in the project area are clear and warm, one would expect that photolysis rates would be relatively high and subsequent half-lives relatively short. One would also expect that, although largely unstudied, marine bacteria and other microorganisms would play roles in the biotransformation of energetic materials to compounds of reduced to no toxicity. Because of the initial small quantities of energetic materials that could potentially be ejected and the large-scale oceanic mixing and dispersion dynamics it is unlikely that concentrations near EC_{50} or LC_{50} determined in laboratory toxicology studies would be achieved. Additionally, these would be one-time events of short duration.

9.3.04 Nesting birds may be potentially exposed to energetic materials and their breakdown products via incidental ingestion of site soils during nesting activities. As seabirds are marine foragers, exposure to energetic materials through ingestion of food items would not be expected. As discussed above, these energetic materials appear to have low potential to bioaccumulate.

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Figures

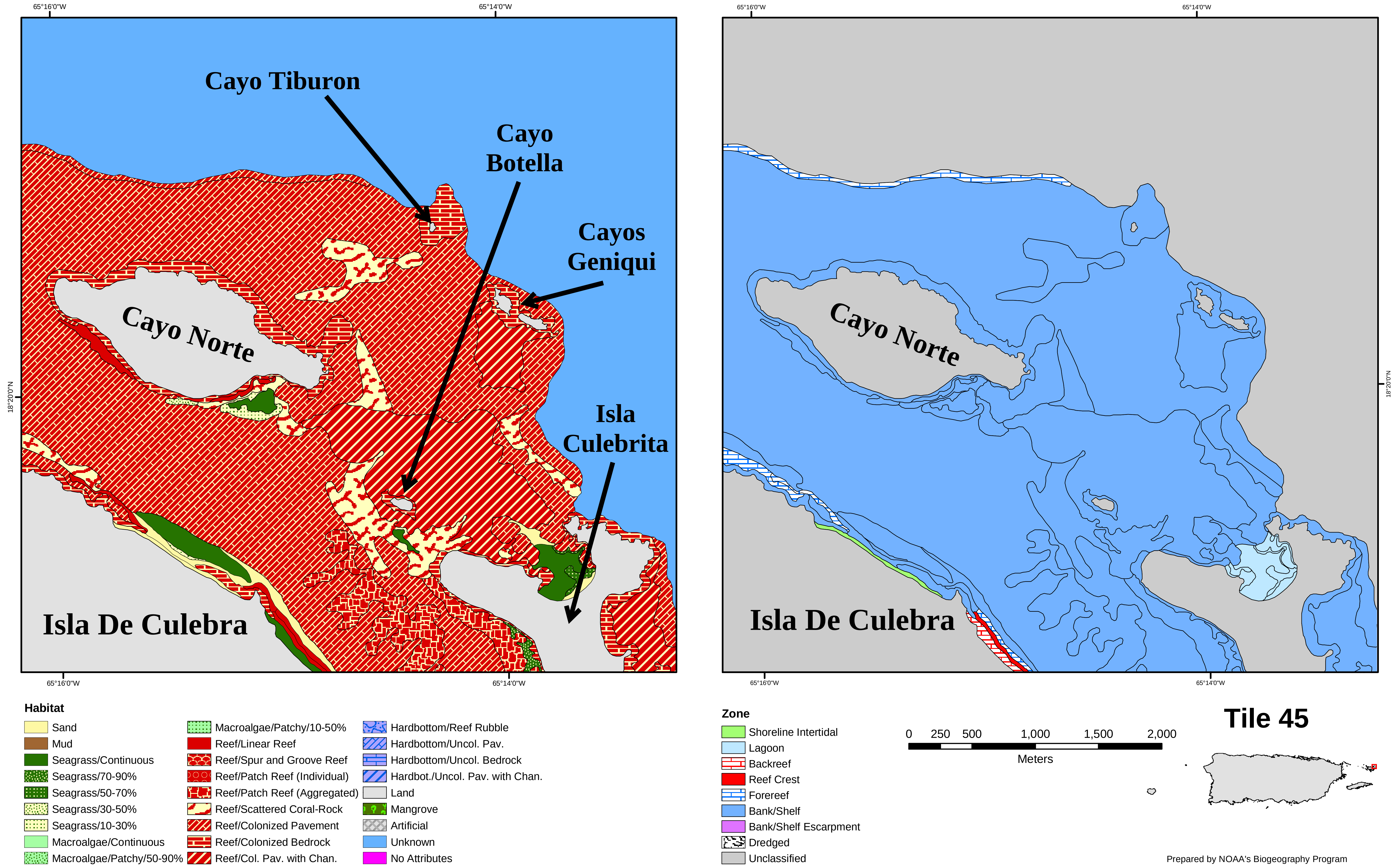
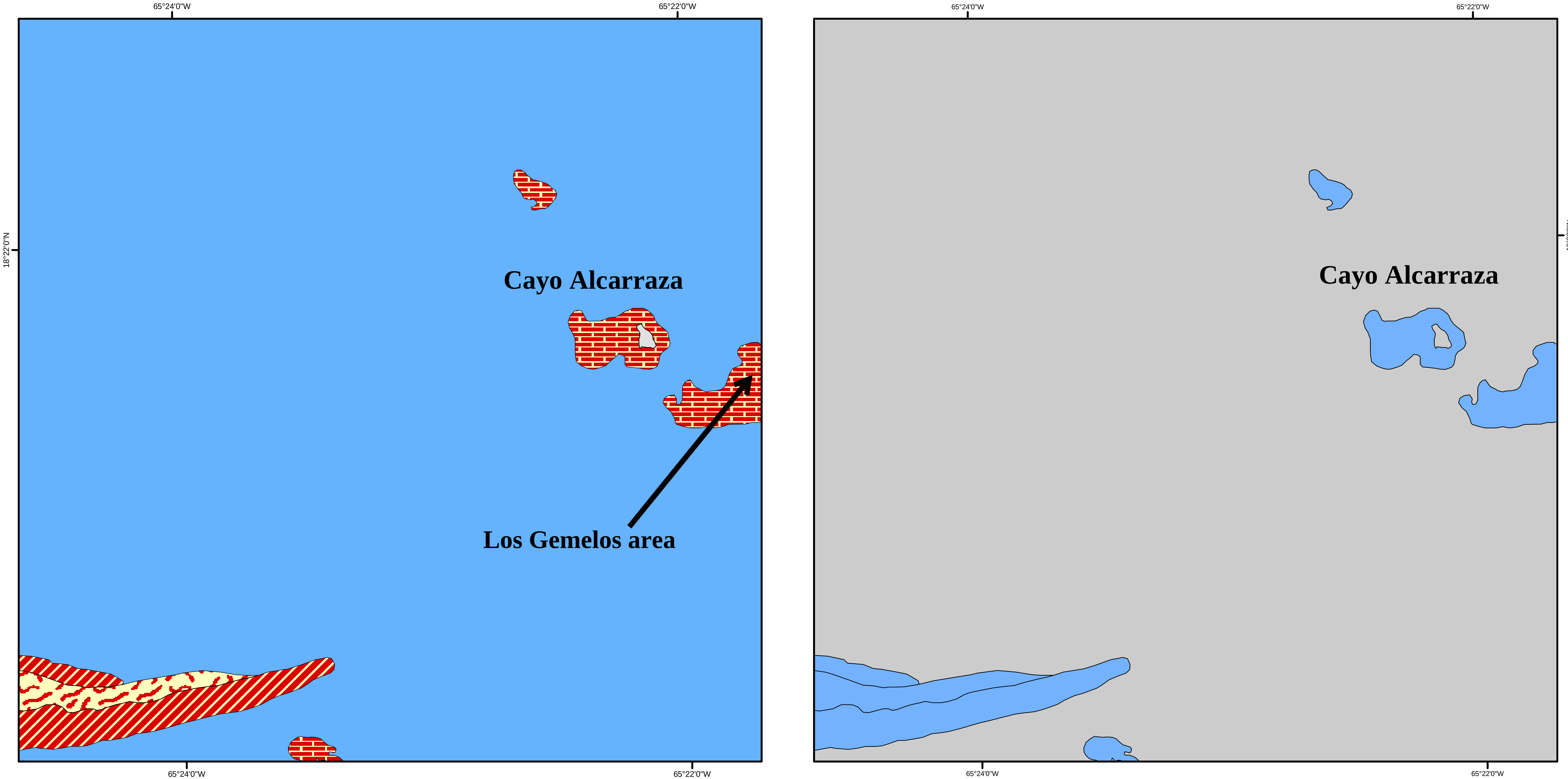


Figure I-1 NOAA Benthic Habitat Map - Isla Culebrita, Cayo Botella, Cayos Geniqui, and Cayo Tiburon



Habitat

- Sand
- Mud
- Seagrass/Continuous
- Seagrass/70-90%
- Seagrass/50-70%
- Seagrass/30-50%
- Seagrass/10-30%
- Macroalgae/Continuous
- Macroalgae/Patchy/50-90%
- Macroalgae/Patchy/10-50%
- Reef/Linear Reef
- Reef/Spur and Groove Reef
- Reef/Patch Reef (Individual)
- Reef/Patch Reef (Aggregated)
- Reef/Scattered Coral-Rock
- Reef/Colonized Pavement
- Reef/Colonized Bedrock
- Reef/Col. Pav. with Chan.
- Hardbottom/Reef Rubble
- Hardbottom/Uncol. Pav.
- Hardbottom/Uncol. Bedrock
- Hardbot./Uncol. Pav. with Chan.
- Land
- Mangrove
- Artificial
- Unknown
- No Attributes

Zone

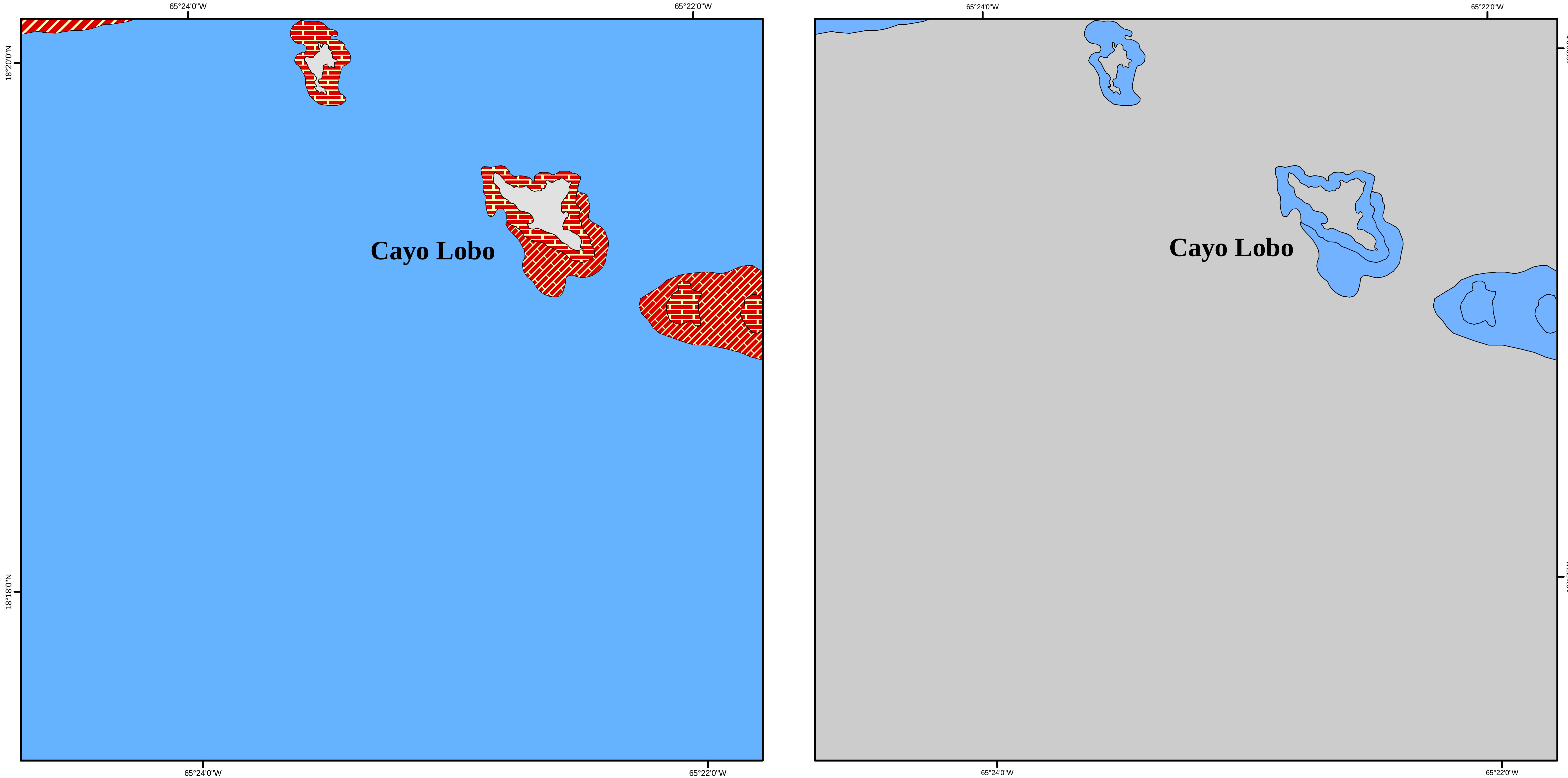
- Shoreline Intertidal
- Lagoon
- Backreef
- Reef Crest
- Forereef
- Bank/Shelf
- Bank/Shelf Escarpment
- Dredged
- Unclassified

0 250 500 1,000 1,500 2,000
Meters

Tile 41

Prepared by NOAA's Biogeography Program

Figure I-2 NOAA Benthic Habitat Map - Cayo Alcarraza and Los Gemelos

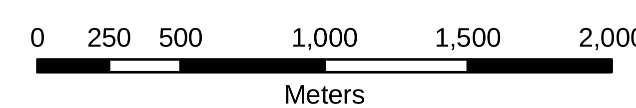


Habitat

- Sand
- Mud
- Seagrass/Continuous
- Seagrass/70-90%
- Seagrass/50-70%
- Seagrass/30-50%
- Seagrass/10-30%
- Macroalgae/Continuous
- Macroalgae/Patchy/50-90%
- Macroalgae/Patchy/10-50%
- Reef/Linear Reef
- Reef/Spur and Groove Reef
- Reef/Patch Reef (Individual)
- Reef/Patch Reef (Aggregated)
- Reef/Scattered Coral-Rock
- Reef/Colonized Pavement
- Reef/Colonized Bedrock
- Reef/Col. Pav. with Chan.
- Hardbottom/Reef Rubble
- Hardbottom/Uncol. Pav.
- Hardbottom/Uncol. Bedrock
- Hardbot./Uncol. Pav. with Chan.
- Land
- Mangrove
- Artificial
- Unknown
- No Attributes

Zone

- Shoreline Intertidal
- Lagoon
- Backreef
- Reef Crest
- Forereef
- Bank/Shelf
- Bank/Shelf Escarpment
- Dredged
- Unclassified



Tile 42

Prepared by NOAA's Biogeography Program

Figure I-3 NOAA Benthic Habitat Map - Cayo Lobo

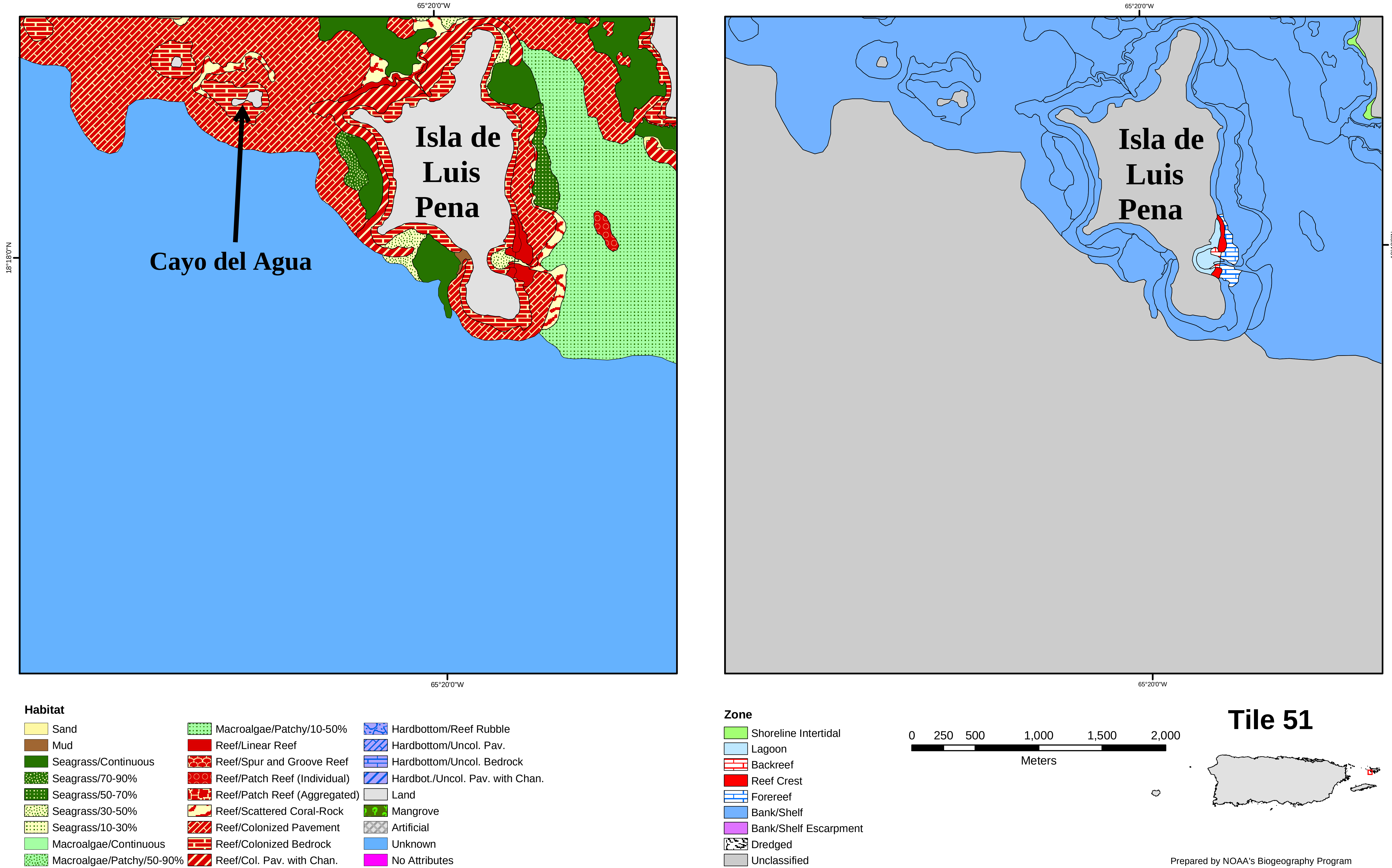


Figure I-4 NOAA Benthic Habitat Map - Cayo del Agua

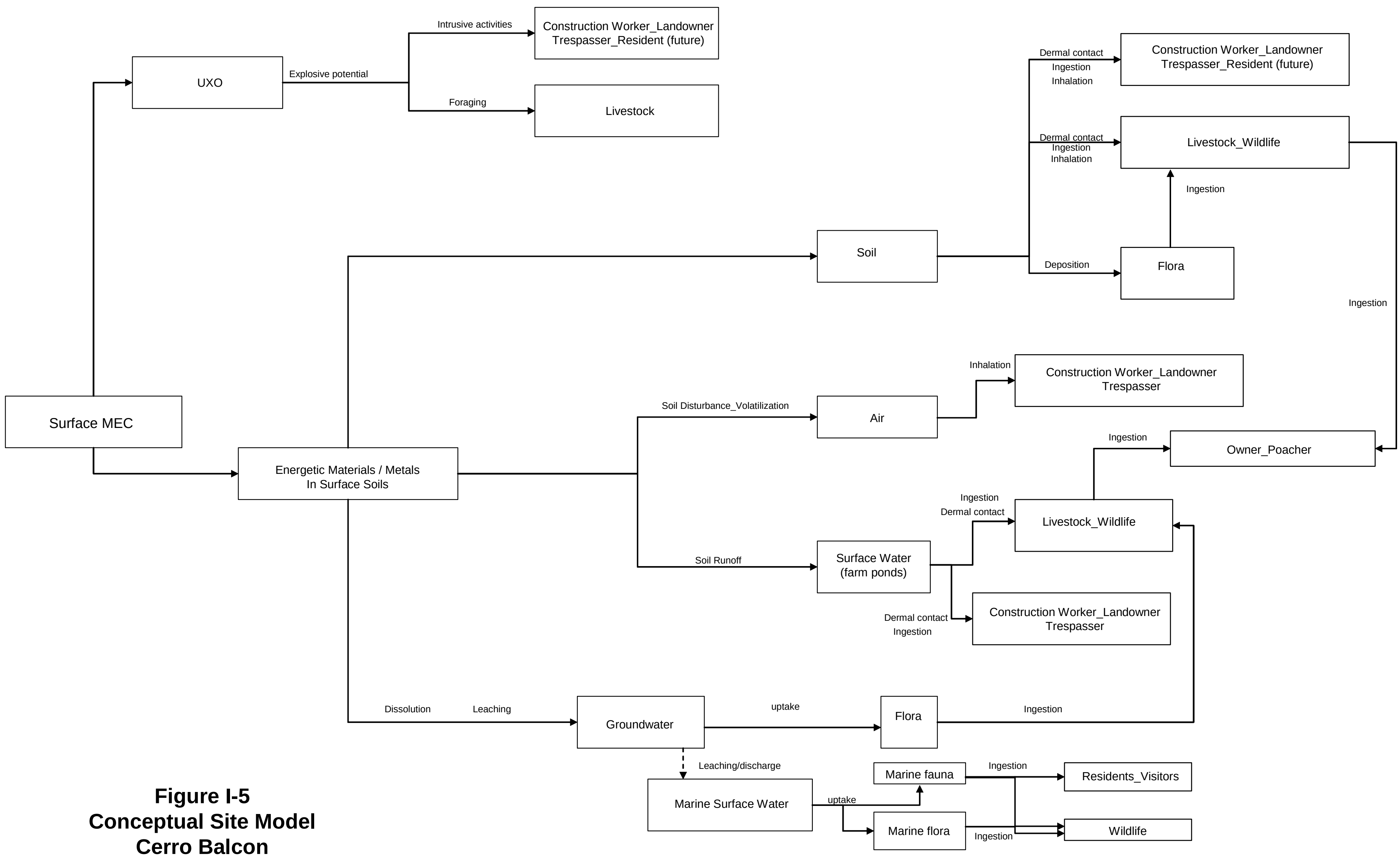


Figure I-5
Conceptual Site Model
Cerro Balcon

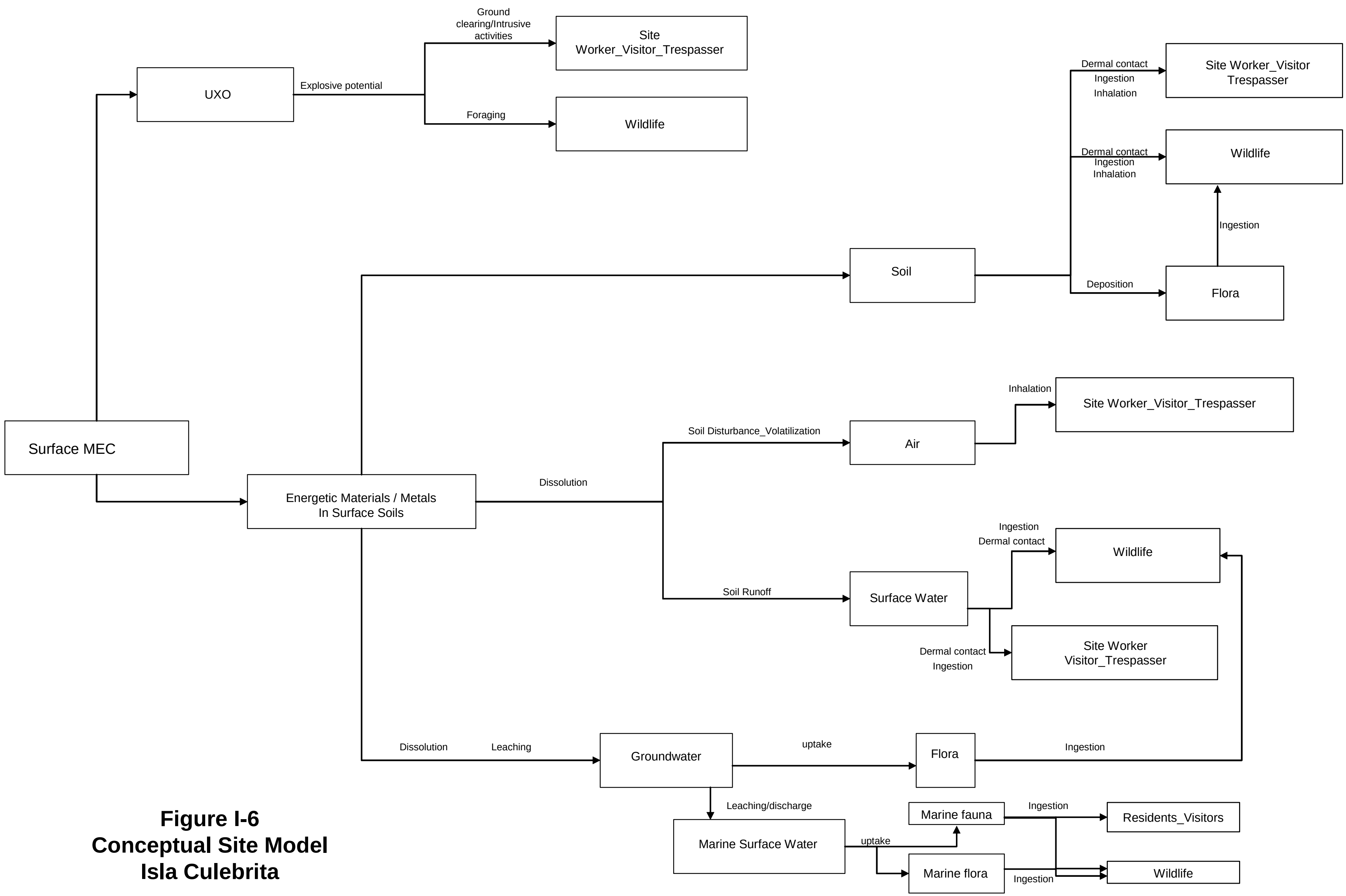


Figure I-6
Conceptual Site Model
Isla Culebrita

APPENDIX J

Protected Species and Habitat Protocols

Contents

Abbreviations & Acronyms

BIP	blow in place
CFR	Code of Federal Regulations
DNER	Department of Natural and Environmental Resources
EEG	Ellis Environmental Group, LC
EQB	Environmental Quality Board
ESA	Endangered Species Act
FWS	Fish and Wildlife Service
GPS	global positioning system
MEC	munitions and explosives of concern
mm	millimeter
NMFS	National Marine Fisheries Service
NWR	National Wildlife Refuge
SUXOS	senior unexploded ordnance supervisor
USACE	United States Army Corps of Engineers
UXO	unexploded ordnance

1.0 Purpose

1.0.01 The purpose of these protocols is to provide specific guidance concerning the protection of threatened and endangered species and their habitats. These guidelines will address the procedures that will be employed to protect endangered and threatened species while performing munitions and explosives of concern (MEC) removal activities during this project.

1.0.02 In the event that MEC requiring destruction in place is in such close proximity to a protected species as to preclude protection of the species using reasonable methods, the appropriate regulatory agency will be notified for a decision as to disposition of the protected species. This may include pruning for propagation and re-introduction of the plant after the MEC has been destroyed or relocation of the plant.

1.1 Preliminary Actions

1.1.01 Ellis Environmental Group, LC (EEG) will coordinate with the Puerto Rico Department of Natural and Environmental Resources (DNER) prior to cutting any vegetation at the site.

1.1.02 Clearance of vegetation on the United States Fish and Wildlife Service (FWS) refuge will require close coordination with FWS, DNER, and Puerto Rico Environmental Quality Board (EQB) personnel. EEG will use a qualified tropical botanist prior to the start of any clearance operations at any of the work sites to perform a protected species and habitat survey.

1.1.03 The locations of protected species and habitats found in EEG's work areas will be located using a global positioning system (GPS). The collected location data including types of species found will be delineated on a map and provided to regulatory personnel.

1.1.04 During the survey, protected species and habitats will be photographed to document the physical nature of the species for use in comparisons after the clearance has occurred and to be used during the site-specific training of the field team members. Wetlands areas will be delineated during the species and habitat survey by the tropical botanist.

1.2 Personnel Training

1.2.01 All on-site project personnel will be instructed during site orientation training of the potential threatened and endangered species in the area and of the need to avoid harming these plants and animals.

1.2.02 On-site personnel will be instructed that civil and criminal penalties exist for harming, harassing, or killing birds, manatees, sea turtles, dolphins, or whales, which are protected under the Marine Mammal Protection Act of 1972, the Endangered Species Act (ESA) of 1973, and Puerto Rico DNER Regulation Number 6766 for the preservation of vulnerable species and species in danger of extinction (February 11, 2004).

1.3 Regulatory Interfaces

The EEG site manager will consult with appropriate agencies concerning threatened and endangered species to ensure that the operations do not negatively impact endangered plants and animals.

1.4 Vegetation Trimming and Pruning

1.4.01 EEG plans to trim and prune only the minimum amount of vegetation on the cays and Culebrita in order to allow our personnel access to the MEC removal areas. If necessary, EEG may trim grasses to no less than 6 inches in height.

1.4.02 Underbrush and trees may be pruned to a height of 12 inches from the ground surface or less to allow full instrument coverage underneath the trees. Most vegetation removal will be conducted on the FWS reserve using hand tools (weed-eaters, trimmers, etc.). Heavier equipment may be used for clearance at Cerro Balcon. The EEG site manager will coordinate with DNER and FWS to take cuttings of plants as previously agreed.

1.4.03 To the extent possible, native trees greater than 2 inches in diameter must be left in place; however, they may be lightly pruned as required to allow full coverage of the ground with the geophysical sensors. In cases where MEC is found embedded in a native tree, FWS and DNER will be notified prior to removal. Invasive plants such as mesquite can be removed. All protected native trees which should not be pruned or removed as part the removal action will be flagged.

1.5 Detonations in the Vicinity of Sensitive Species and Habitats

1.5.01 If necessary, a sandbag barricade will be constructed to ensure that the species or habitat is protected. The barricade will be of sufficient height (2 to 4 feet tall) to protect the main part of the vegetation from fragmentation. Before and after photographs will be taken to show the extent of impact to the area after the detonation has occurred.

1.5.02 To reduce noise and fragmentation during detonations, MEC up to 155 millimeters (mm) will be tamped with sandbags per United States Army Corps of Engineers (USACE) guidance documents. Items greater than 155 mm will be tamped using loose soil in accordance with the buried explosion module (BEM). Vegetation surrounding detonation points will be wetted to prevent fires. Water mitigation of fragmentation may be used in lieu of sandbags.

1.6 Negative Species or Habitat Impacts

In the unlikely event that a threatened or endangered species or habitat is harmed as a result of MEC removal activities, the damage will be photographed and the photographs submitted to the EEG project manager with a description of the cause of the damage. On any future demolition shots, root cause analysis will be performed and adjustments to the procedures will be initiated to prevent recurrence.

2.0 Sensitive Environment Operations

2.1 Wetlands

The wetlands survey will be reviewed by the responsible environmental resources agencies, as appropriate, before clearance operations are conducted. EEG will perform clearance activities in wetland areas during this investigation; however, EEG will not perform clearance activities within the submerged portions of the wetlands. Submerged portions of the wetlands will be delineated by GPS at the time of the MEC removal action.

2.2 Sea Turtle Nesting Areas

Beaches on Isla Culebrita within the authorized project area will be surface-cleared of MEC. On Culebrita, all beachfront areas on the southwest-facing shore, east-facing shore, and northwest-facing shore of the island from mean high tide inland to a point 150 meters from shore have been designated critical habitat for hawksbill sea turtles (50 Code of Federal Regulations [CFR] 17.95).

2.2.1 Sea Turtle Nesting Season

The nesting season varies with locality, but in most locations nesting occurs sometime between April and November. Hawksbill sea turtles may nest all year. Hawksbills nest at night, although there are reports of daytime nesting, and, on average, about 4 to 5 times per season at intervals of approximately 14 to 19 days. Each clutch contains 70 to 160 eggs, which hatch in about 60 days.

Nesting behavior follows a general sequence of that of other species of sea turtles: emergence from the sea, site selection, site clearing and pit construction, egg chamber construction, egg laying, filling in the egg chamber, disguising the nest site, and returning to sea. The entire process takes about 1 to 3 hours.

2.2.2 Clearance Operations In and Around Turtle Nesting Areas

2.2.2.01 Prior to the initiation of clearance activities on Culebrita and additional cays, beach clearance crews will be briefed as to the endangered status of sea turtles, potential penalties associated with violation of ESA crawl and nest identification, and sea turtle biology.

2.2.2.02 Prior to the initiation of clearance activities on beaches, the senior unexploded ordnance supervisor (SUXOS), the crew leader, and the site manager will coordinate with the refuge manager and monitoring personnel as to known locations of sea turtle nests as determined through agency nest monitoring. The site manager will communicate daily with the refuge manager as to whether monitoring personnel have located new nest locations within the work area since the initial briefing. If possible, the clearance team leader and FWS personnel will visit the nest locations to ensure positive identification of these locations. If agreed upon by FWS, nest locations will be unobtrusively marked to aid clearance personnel in nest avoidance. All beach clearance activities will be closely coordinated with FWS and agency nest monitoring personnel.

2.2.2.03 The critical habitat boundaries of the hawksbill sea turtle on Culebrita will be determined and marked on aerial photographs to aid clearance crews in the identification of this habitat. Clearance of vegetation within critical habitat will be kept to the absolute minimum required for the identification of MEC. No sea grapes or other larger plants will be cut within designated critical habitat boundaries; however, these plants may be lightly pruned in order to gain access to detected MEC.

2.2.2.04 If clearance crews believe that they have identified an unknown nest location, clearance activities surrounding the suspected nest will cease, the location recorded, and FWS contacted for confirmation. A 10-foot buffer around suspected turtle nests will be investigated without approval and coordination with the responsible regulatory agencies.

2.2.2.05 In the event that a partially buried MEC that is acceptable to be moved is located adjacent to a sea turtle nest, FWS will be contacted to determine the best course of action to minimize impact to the nest. If MEC requiring blow in place (BIP) is located adjacent to a sea turtle nest, detonation will be postponed and FWS and USACE will be immediately notified so that, through discussion, the best alternative course of action to avoid nest disturbance may be determined. Digital photos will be taken of the situation and e-mailed to involved parties to aid in discussion.

2.2.2.06 All efforts will be made to avoid sand compaction surrounding nest locations. Any ruts or holes created as a result of clearance activities will be graded to prevent potential barriers to hatchlings.

2.3 Access and Egress at Culebrita and the Cays

The extensive seagrass beds of the Culebra archipelago support a large juvenile population of green turtles. Transport boats to and from the cays will watch for and avoid sea turtles in the water. Should a turtle be struck and injured or killed during transport of crews, the National Marine Fisheries Service (NMFS) protected species coordinator and DNER will be notified. The same will apply to marine mammals.

2.4 Benthic Environment

2.4.01 Access to the cays will be dependent on wind, wave, and current directions.

2.4.02 EEG will assess the access routes and points to the cays and coordinate them with the applicable regulatory agencies.

2.4.03 The transport boat utilized for the smaller cays will remain offshore.

2.4.04 Clearance crews and equipment will be ferried to the cays with an inflatable-type craft.

2.4.05 If anchoring is to be performed, anchoring locations will be determined in concurrence with the responsible environmental agencies prior to work commencing on the cays.

2.5 Endangered and Threatened Bird Species

2.5.01 The following table lists the known endangered and threatened bird species that may be located in the project area.

Threatened and Endangered Bird Species Potentially Occurring in Culebra Island Archipelago

Latin Name	English Common Name	Spanish Common Name	FWS ESA Status	Puerto Rico Status
Pelicanus occidentalis occidentalis	Brown pelican	Pelícano pardo	E	E
Falco peregrinus tundrius	Peregrine falcon	Falcón peregrino	NL	CE
Sterna dougalli	Roseate tern	Palometa	T	V
Oxyura dominica	Masked duck	Pato dominico	NL	E
Oxyura jamaicensis	Ruddy duck	Pato chorizo	NL	V
Fulica caribaea	Caribbean coot	Gallinazo caribeño	NL	V
Tachybaptus dominicus	Least grebe	Tigua	NL	DD
Dendrocygna arborea	West Indian whistling duck	Chiriria antillano	NL	CE
Anas bahamensis	White cheeked pintail	Pato quijada colorada	NL	V
Sterna antillarum	Least tern	Gaviota chica	NL	DD
Columba leucocephala	White crowned pigeon	Paloma cabeciblanca	NL	DD
Geotrygon mystacea	Bridled quail dove	Paloma perdiz de Martinica	NL	DD
Charadrius melodus	Piping plover	Chorlo melódico	T	CE
Key: CE = Critically endangered; DD = Deficient data; E = Endangered; NL = Not listed; T = Threatened; V = Vulnerable				

2.5.02 The cays surrounding Culebra are known nesting areas for shorebirds and seabirds. The volcanic rocks and cays of northeastern Puerto Rico provide a suitable habitat for the nesting of marine birds. These rocks and cays are unstable and subject to erosion despite their dense vegetative cover. Fourteen species of marine birds nest in the Culebra archipelago (Saliva 2005) (see following table).

Nesting Marine Birds of the Culebra Archipelago

Latin Name	Spanish Common Name	English Common Name
Anous stolidus	Cervera	Brown noddy
Larus atricilla	Gaviota cabecinegra	Laughing gull
Phaethon aethereus	Chirre de pico colorado	Red-billed tropicbird
Phaethon lepturus	Chirre de cola blanca	White-tailed tropicbird
Puffinus lherminieri	Pampero	Audobon’s shearwater
Sterna anaethetus	Gaviota monja	Bridled tern
Sterna dougalli	Palometa	Roseate tern
Sterna eurygnatha	Gaviota de cayena	Cayenne tern
Sterna fuscata	Gaviota oscura	Sooty tern
Sterna maxima	Gaviota real	Royal tern

Latin Name	Spanish Common Name	English Common Name
Sterna sandvicensis	Gaviota piquiaguda	Sandwich tern
Sula dactylatra	Boba enmascarada	Masked booby
Sula leucogaster	Boba parda	Brown booby
Sula sula	Boba patirroja	Red-footed booby
Source: Saliva 2005		

2.5.03 Transport to the work sites and landing of vessels to offload equipment will be coordinated with DNER. Landing sites will be located to avoid impacting coral reef and seagrass bed communities.

2.5.04 Work in all areas of Culebra National Wildlife Refuge (NWR) will be coordinated with the FWS Boquerón field office, the Office of Ecological Services, and/or Culebra NWR before work commences on any site. All work on cays will adhere to a schedule outlined by FWS. The known restrictions to work schedules are listed as follows.

2.5.1 Work Restrictions in Survey Areas

Nesting activities of certain avian species will lead to work restrictions on Isla Culebrita and the cays. During the nesting period, no operations will be allowed on specific cays. Work on these cays must be closely coordinated with DNER and FWS to prevent impact to sensitive species. There will be no restrictions for work at Cerro Balcon due to nesting birds.

2.5.2 Cayos Geniqui, Agua, Lobo, Alcarraza

These cays are utilized year-round as nesting and roosting sites for resident or migratory seabirds and resident terrestrial birds. Any entry onto the cays will be coordinated with the Culebra NWR manager for avoidance of nesting sites. Every reasonable effort will be taken to ensure that desirable nesting habitat cover is not damaged. FWS will provide guidelines for protection of nesting habitats.

2.5.3 Work Restrictions at Cayo del Agua and Cayo Lobo

Migratory seabirds (bridled terns, red-billed tropicbirds, white-tailed tropicbirds, Audubon shearwaters) and/or resident birds (Zenaida doves, white-cheeked pintails, oyster catchers) are present at various months of the year. Entry onto the cays can be made only from September through March through coordination with the Culebra NWR manager, who will identify any existing nests for avoidance. Coordination with DNER is necessary to address the presence of white-cheeked pintails on Cayo del Agua, which are listed as threatened by the Commonwealth of Puerto Rico.

2.5.4 Work Restrictions at Cayos Geniqui

Migratory seabirds (brown boobies, red-footed boobies, bridled terns, laughing gulls, brown noddies, magnificent frigatebirds, white-tailed tropicbirds, red-billed tropicbirds) are present at various months of the year. The only months where entry onto the cay will be allowed are November through January through coordination with the Culebra NWR manager to avoid nesting sites. Any detonation will be done with maximum measures to minimize noise to reduce impacts to birds.

2.5.5 Work Restrictions at Cayo Alcararraza

Migratory seabirds (masked boobies, brown boobies, bridled terns, brown noddies, magnificent frigatebirds) and resident birds (Zenaida doves) are present at various months of the year. The only months where entry onto the cay will be allowed are November through January through coordination with the Culebra NWR manager to avoid nesting sites. Any detonation will be done with maximum measures to minimize noise to reduce impacts to birds.

3.0 References

Saliva, J.E., 2005. “La palometa y las áreas de aniadaje de las aves marinas en Puerto Rico.” *El Bien-te-veo,* Vol 8, No. 2. Sociedad Ornitológica Puertorriqueña, Inc.