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Final

Ordnance and Explosives (OE) Site-Specific Work Plan

for

Solid Waste Management Unit 4

Former U.S. Naval Ammunition Support Detachment
Vieques Island, Puerto Rico

Prepared for

Department of the Navy
Atlantic Division
Naval Facilities Engineering Command

Under the
LANTDIV CLEAN II Program
Contract No. N62470-95-D-6007
CTO-205

Prepared by

CH2MHILL

Tampa, Florida

November 9, 2001

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AFB	Air Force Base
ATF	Alcohol, Tobacco, and Firearms
bgs	Below ground surface
BIP	Blow in place
BRAC	Base Realignment and Closure
CAP	Corrective Action Plan
CAR	Corrective Action Request
CD	Compact disc
CDC	Centers for Disease Control
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CINCPACFLT	Commander in Charge Pacific Fleet
CLEAN	Comprehensive Long-Term Environmental Action Navy
CNS	Central nervous system
COPCs	Contaminants of potential concern
CPR	Cardio-pulmonary resuscitation
CQC	Contractor quality control
CSO	Caretaker Support Office
CWM	Chemical warfare material
DEET	N,N-diethyl meta-toluamide
DGM	Digital geophysical mapping
DGPS	Differential Global Positioning System
DID	Data item description
DoD	Department of Defense
DoI	Department of Interior
DOT	Department of Transportation
DQO	Data quality objective
DRMO	Defense Reutilization Marketing Office
ECM	Earth-covered magazines
EE/CA	Engineering Evaluation/Cost Analysis
EMA	Eastern Maneuver Area
EMM	Earth moving machinery
EO	Expended ordnance
EOD	Explosive ordnance disposal
EOD	Explosive Ordnance Demolition
ERM	Environmental Resources Management
EZ	Exclusion zone

ft	Feet
FUDS	Formerly used defense sites
GFCIs	Ground fault circuit interrupters
GIS	Geographic information system
GPS	Global Positioning System
HASP	Health and Safety Plan
HD	Hazard Division
HE	High Explosive
HR	Heart rate
HSM	Health and Safety Manager
IAS	Initial Assessment Study
IDW	Investigation-derived waste
IR	Installation restoration
IRF	Incident Report Form
IRP	Installation Restoration Program
LANTDIV	Atlantic Division
M&TE	Measuring and test equipment
mm	Millimeter
mph	Miles per hour
MSDS	Material Safety Data Sheet
MV	Milli-volt
N/A	Not available
NASD	Naval Ammunition Support Detachment
NAVFACENGCOM	Naval Facilities Engineering Command
NEW	Net explosive weight
NOSSA	Naval Ordnance Safety and Security Activity
NSC	National Safety Council
NSRR	Naval Station Roosevelt Roads
NTR	Navy Technical Representative
OB/OD	Open burn/open detonation
OE	Ordnance and explosives
OE-SIMS	Ordnance and Explosive Site Information Management System
OESO	Ordnance Explosive Safety Office
OSHA	Occupational Safety and Health Administration
ORNL	Oak Ridge National Laboratory
ORS	OE-related scrap
PA/SI	Preliminary Assessment/Site Investigation
PC	Personal computer

PCBs	Polychlorinated biphenyls
PDGPS	Precision differential global positioning system
PFD	Personal flotation device
PHSM	Project Health and Safety Manager
PPE	Personal protective equipment
QA	Quality assurance
QC	Quality control
QCP	Quality Control Plan
Q-D	Quantity-distance
RBC	Risk based concentration
RF	Radio frequency
RCWM	Recovered Chemical Warfare Material
RFI	Request for Information
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RMSF	Rocky Mountain spotted fever
ROTHR	Relocatable Over The Horizon Radar
RPM	Remediation project manager
SOP	Standard of Practice
SOW	Scope of work
SSC	Site Safety Coordinator
SUXOS	Senior UXO Supervisor
SUXOSS	Senior UXO Supervisor Specialist
SVOC	Semi-volatile organic compound
TBD	To be determined
TDEM	Time-domain electromagnetic
TSDF	Treatment, storage, and disposal facility
USEPA	U.S. Environmental Protection Agency
USRADS	Ultrasonic ranging and data system
UXO	Unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
VOC	Volatile organic compound
WTA	Western Training Area

SECTION 1

Introduction

This Site-Specific Work Plan for the Phase I Ordnance and Explosives (OE) investigation at the former open burn/open detonation (OB/OD) site at the former U.S. Naval Ammunition Support Detachment (NASD), Vieques Island, Puerto Rico, has been prepared to address site-specific response actions to be taken to minimize risks to human health, safety, and the environment from potential exposure to OE that may be present at the site as a result of past Department of Defense (DoD) activities conducted at the facility. This Site-Specific OE Work Plan has been prepared by CH2M HILL for the Naval Facilities Engineering Command (NAVFACENGCOM) Atlantic Division (LANTDIV) to meet the current DoD requirements for investigation of OE.

This Work Plan was prepared by CH2M HILL under Navy Contract N62470-95-D-6007, Navy Comprehensive Long-Term Environmental Action Navy (CLEAN), District III, Contract Task Order 205. This site is also under investigation for hazardous constituents under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and has been designated by the U.S. Environmental Protection Agency (USEPA) as Solid Waste Management Unit-4 (SWMU 4).

This Work Plan presents site-specific information related to SWMU 4 and is designed to supplement the OE Master Work Plan for the Former NASD (CH2M HILL, October 2001). The OE Master Work Plan provides the background information needed to understand OE/unexploded ordnance (UXO) site conditions, the approach to be used for investigations, and general types of activities to be accomplished at OE sites within the Former NASD. Only supporting documentation relating to SWMU 4, including additions/deviations from the OE Master Work Plan, are presented within this document. The organization of this work plan is summarized below. Table 1-1 summarizes the site-specific updates to the OE Master Work Plan for the Former NASD.

Numerous OE/UXO related safety regulations are cited throughout this document as they apply to OE field investigations at SWMU 4. Applicable, relevant, or appropriate regulations (ARARs) that may be considered during implementation of OE investigation and removal efforts are listed in Table 1-1 of the OE Master Work Plan for the Former NASD.

Section 1, Introduction-Presents the purpose of the Phase I OE investigation at the site, provides a description of SWMU 4, and summarizes previous investigations conducted at the site.

Section 2, Technical Management Plan-Identifies the approach, methods, and operational procedures to be employed during investigation activities. Specific procedures for certain tasks are included by reference to the appropriate subsection of this Work Plan.

Section 3, Explosives Management Plan-Details the specific method for management of acquisition, receipt, storage, inventory, reporting, and return of explosives in accordance with applicable safety regulations.

TABLE 1-1
OE Site-specific Work Plan Organization

Section	Name	Site-Specific Update	Description
1	Introduction	Yes	Provides overview of Site-Specific Work Plan
2	Technical Management Plan	Yes	Provides site-specific details for site approach, intrusive investigations, field documentation, data management, and site safety.
3	Explosives Management Plan	Yes	Provides site-specific details for notification and coordination; training; equipment requirements; explosive disposal operation; range operators, and blow-in-place operators.
4	Explosives Siting Plan	Yes	Provides details of explosive siting.
5	Geophysical Plan	No	Refer to Section 5 of the OE Master Work Plan.
6	CH2M HILL Site Safety and Health Plan	No	This Site Safety and Health Plan has been updated to include site-specific information and UXO contractor contact information.
7	Location Surveys and Mapping Plan	No	Refer to Section 7 of the OE Master Work Plan.
8	Sampling and Analysis Plan	No	Refer to Section 8 of the OE Master Work Plan.
9	Quality Control Plan	Yes	Provides site-specific schedule not provided in the OE Master Work Plan.
10	Environmental Protection Plan	No	Refer to the OE Master Work Plan.
11	Investigation-Derived Waste Management Plan	No	Refer to the OE Master Work Plan and NASD Master Work Plan.
12	Geophysical Information System Plan	No	Refer to the OE Master Work Plan.
13	References	No	Original reference list included for reference.
Appendix A	Ordnance-Related Scrap Metal Collection and Inspection Procedures	Yes	Procedures for Scrap Metal Collection and Inspection
Appendix B	Key UXO Personnel Resumes	Yes	Resumes provided for key UXO/OE personnel
Appendix C	Personnel Qualification Verification Forms	Yes	Forms included from the OE Master Work Plan for reference.

Note: Additional site-specific procedures will be defined after selection of the geophysical subcontractor(s) for each site.

Section 4, Explosives Siting Plan-Details the explosives safety criteria for planning and siting explosives operations.

Section 5, Geophysical Investigation Plan-Describes the approach, methods, and operational procedures employed to perform geophysical investigations during OE activities at SWMU 4.

Section 6, CH2M HILL Site Safety and Health Plan-Describes the Safety and Health Program and presents safety and health information and requirements to be followed during OE activities.

Section 7, Location Surveys and Mapping Plan-Describes the methods, equipment and accuracy requirements for location surveys and mapping in support of removal activities.

Section 8, Sampling and Analysis Plan-Describes the requirements for sampling and analysis, quality assurance/ quality control, laboratory qualification, data acquisition and chain-of-custody for samples that will be collected during removal activities.

Section 9, Quality Control Plan-Describes the approach, methods, and operational procedures to be used for the performance of quality control during removal activities.

Section 10, Environmental Protection Plan-Describes the approach, methods, and operation procedures to be implemented to protect the natural environment during removal activities.

Section 11, Investigation-Derived Waste Management Plan-Describes the requirements for managing investigation-derived waste (IDW) generated during removal activities.

Section 12, Geographical Information System Plan-Describes the requirements for the geographical information system (GIS) to be utilized during assessment activities.

Section 13, References-Lists documents cited in this Site-Specific OE Work Plan.

1.1 SWMU 4 Description

1.1.1 Physical Characteristics of the Site

The former OB/OD area at SWMU 4 is described as 200 yards wide by 0.5 miles long, or 36.4 acres (approximately 40 acres). The OB/OD area extended along the western shore of Vieques south of Punta Boca Quebrada. Previous investigations in June 2000 indicated that UXO projectiles most likely expelled by explosive force during from OB/OD operations, were found as far as approximately 2,000 feet (ft) east of the center point of the 40-acre site. A buffer zone of 1,000 ft was added to this distance and an arc with a radius of 3,000 ft was inscribed to define an area to be fenced off. The 3,000-ft arc comprises an area of approximately 400 acres. The 2,000-ft arc around the SWMU 4 site (area with known UXO items from OB/OD operations) encompasses approximately 200 acres. Figures 1-1 and 1-2 present the location of the Former NASD and the location of SWMU 4 in relation to the Former NASD, respectively.

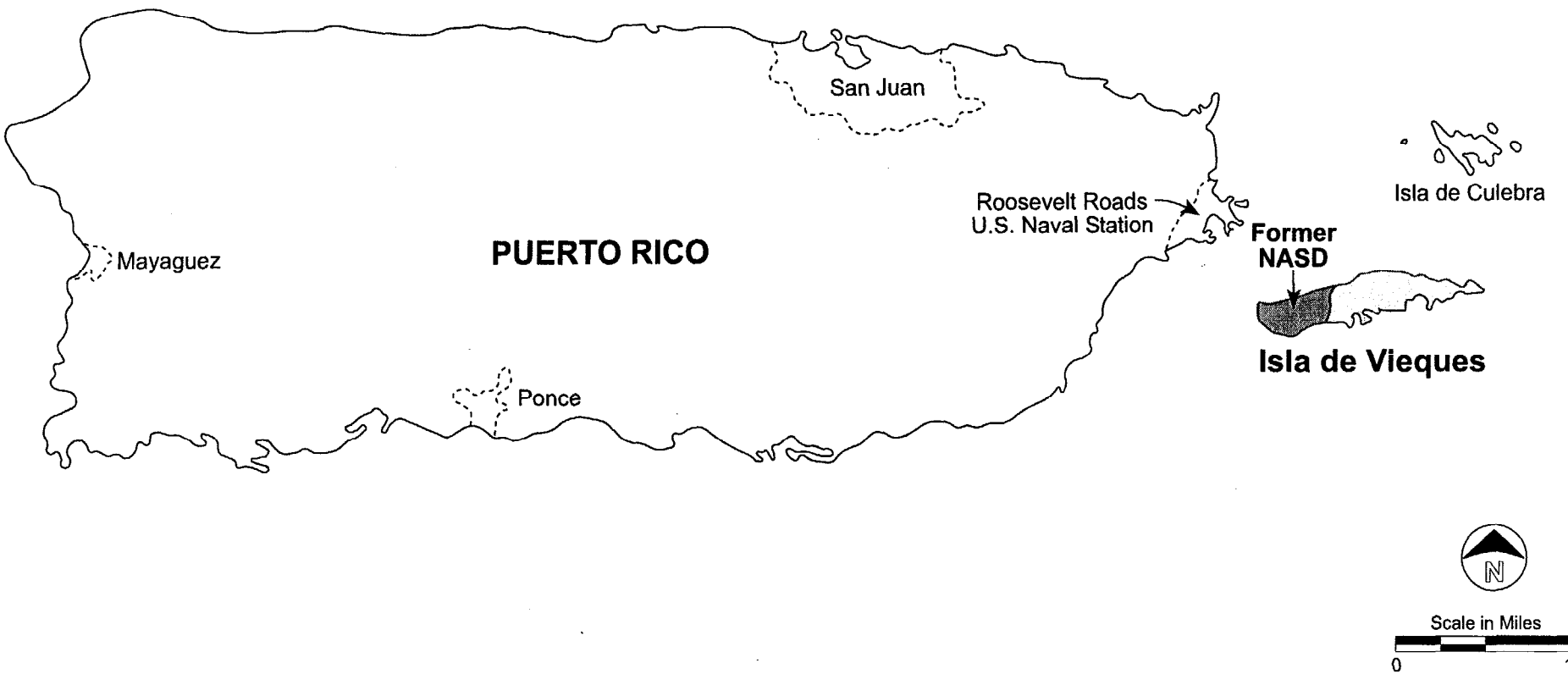

Figure 1-1
SITE LOCATION MAP
Former NASD, Vieques Island, Puerto Rico

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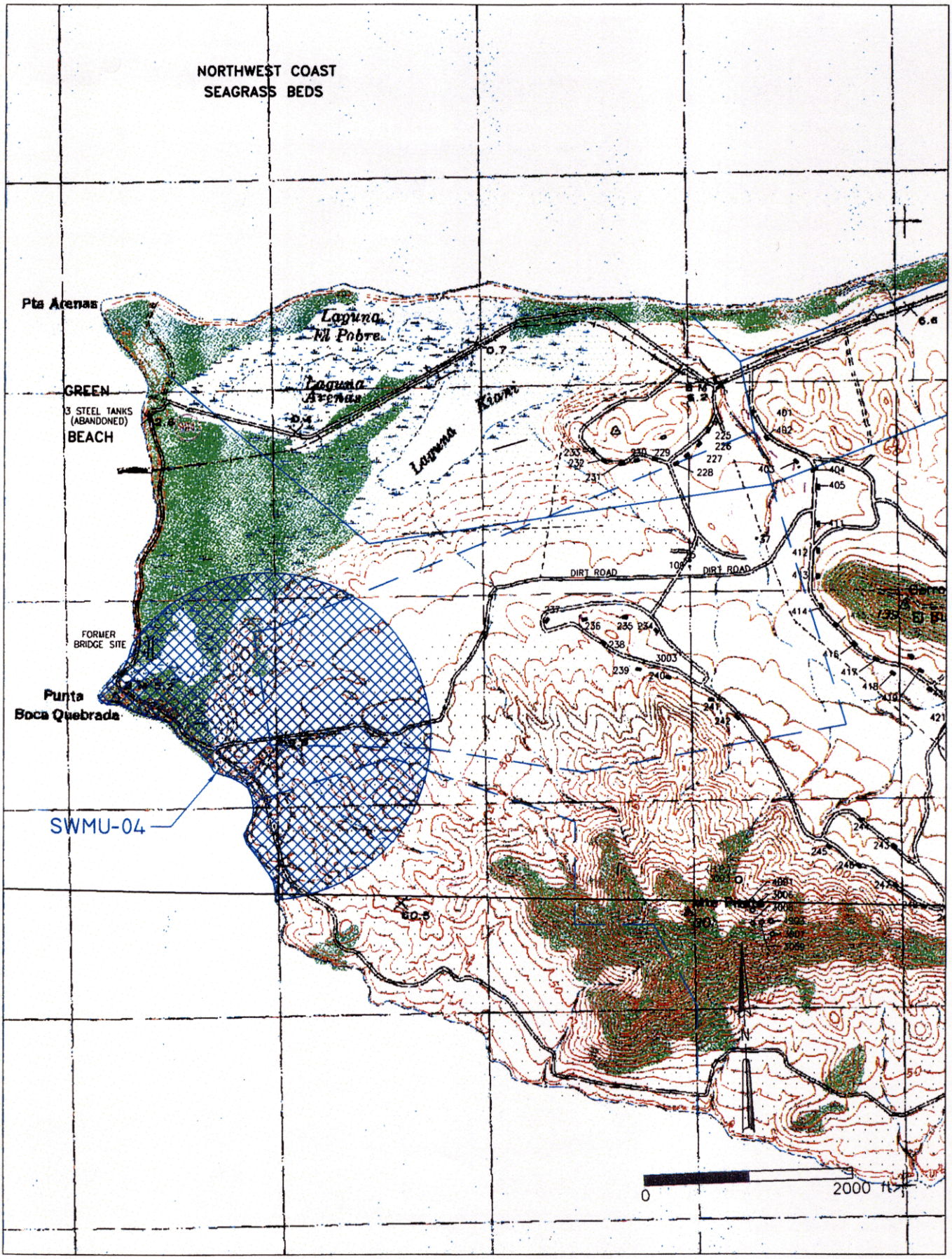


T:\Environmental\Puerto Rico Drawings\Vieques\Fig1-2.dwg

Figure 1-2
SWMU-04 Site Location Map
Former NASD, Vieques Island, Puerto Rico

CH2MHILL

Land surface elevations in the SWMU 4 area range from sea level to approximately 150 ft above mean sea level. The southern portion of the site borders the flanks of Mt. Pirata and has the highest elevation (150 ft). The northern part of the site extends into a salt water lagoon near Punta Boca Quebrada and has the lowest elevations (mean sea level). The main OB/OD 40 acre area is relatively flat, except where a quebrada (drainage area that is dry except during storm events) cuts through the southern end of the site. The 40-acre area ranges in elevation from sea level to approximately 50 ft above sea level.

The majority of SWMU 4 has a dense shrub canopy of thorny shrubs and a scattered herbaceous stratum. The total vegetative cover was approximately 75 to 95 percent. Dominant shrubs identified on the site included *Acacia farnenciana, Prosopis glandulosa, Pithlcellobium dulce,* and *Zanthoxylum brevipes*. Another co-dominant shrub was *Leucaena leucocephala.* The herbaceous stratum was dominated by *Bothriochloa ischaemum, Commelina erecta, C. diffusa,* and *Lasiacis divaricata.* No endangered or threatened plant species were observed during the field survey.

1.1.2 Past Uses of the Site

The OB/OD unit was utilized for the thermal destruction of waste munitions, fuels, and propellants from 1969 to 1979. These materials were placed in the open burn area and a squib or other detonator was placed in the waste material. The open burn was then initiated from a safe distance using electrical detonation. The inactive OB/OD area reportedly was swept for live munitions by an Explosive Ordnance Demolition (EOD) team from Naval Station Roosevelt Roads (NSRR) in 1976 and at least two additional times by 1979. The range was fully closed in 1979 (Greenleaf/Telesca, 1984). Records reviewed during the Initial Assessment Study (IAS) completed in 1984 indicate that the site may have been used since the late 1940s.

In addition to the OB/OD activities, this location was also used for the disposal of excess and retrograde ammunition and, twice yearly, for disposal of unexploded munitions found around the targets on the Eastern Maneuver Area (EMA). The EMA is located in the eastern portion of Vieques Island and is not part of the Former NASD. Other explosive materials disposed at SWMU 4 included material from the rework of munitions (e.g., loose powder and primers) and ordnance items from the torpedo shop. Materials disposed of at the site included flares and cartridge-activated devices. The range had a maximum blow limit of 4,000 pounds of TNT equivalent according to the IAS report.

1.2 Site Background

This section briefly summarizes site background information, including past owners of the facility, the environmental history of the site, and previous investigations conducted at the site.

1.2.1 Past and Present Ownership

The Former NASD was utilized by the U.S. Navy Atlantic Fleet for storage of munitions from approximately 1942 to 2001. Activities at the Former NASD were directed under the consolidated command of Commander Fleet Air Caribbean, Naval Forces Caribbean, and Antilles Defense Command, whose headquarters are at NSRR. The mission of the Former

NASD was to receive, store, and issue all ordnance authorized by NSRR for support of Atlantic Fleet activities.

SWMU 4 is situated within the approximate 3,100 acres retained by the U.S. Government as part of the Former NASD land transfer on April 30, 2001 mandated by former President Clinton's directive of January 31, 2000. The 3,100 acres, consisting of the Conservation Zone at the Former NASD, referenced in section IV of the 1983 Memorandum of Understanding between the Municipality of Vieques and the Secretary of the Navy, were transferred to the Department of Interior (DOI) to be managed under a Cooperative Agreement between the Commonwealth of Puerto Rico, the Puerto Rico Conservation Trust, and the Secretary of the Interior.

Details of the land transfer are provided in the *Findings of Suitability for Early Transfer for U.S. Naval Ammunition Support Detachment, Vieques Puerto Rico* (CH2M HILL, November, 2000). Additional information related to the administration of this property is detailed in the *Site Management Plan for the Former NASD Facility, Vieques, Puerto Rico* (CH2M HILL, July, 2001).

1.2.2 Environmental History

The environmental history of SWMU 4 was based on records reviews and interviews conducted from 1984 through 2000. These records reviews and interviews included the IAS (Greenleaf/Telesca, 1984), and an Environmental Baseline Study (EBS) (Program Management Company, 2000). Results of the record searches and interviews for each investigation are summarized below.

1.2.2.1 Initial Assessment Study

An IAS was conducted for the Former NASD in 1984 to identify and assess sites posing a potential threat to human health or the environment due to contamination from past hazardous waste operations. At the time of the IAS, the site was designated as Site 19, West EOD Range, Vieques.

Records indicated that the West EOD range was the primary disposal area for Vieques. Activities included the disposal of excess and retrograde ammunition and, on a twice-yearly basis, unexploded munitions found around the targets on the EMA. Material disposed of at the site include 8-inch rounds fired in the EMA, and 105 millimeter (mm), 106 mm, and 175 mm duds fired from Punta Cereja. Other sources of OE included the material from the rework of munitions (loose power, primers) and ordnance items from the Torpedo Shop. Materials disposed at the site also included flares and cartridge-activated devices. The IAS report contained inconsistencies, however, indicating either a maximum blow limit of 4,000 pounds of TNT equivalent, or a 40,000-pound explosive limit.

According to record reviews, the EOD range was determined to be in operation from at least 1969 to 1979. Some interviewees, however, had indicated that the site was used since the early 1940s. The range closed to most uses in 1976. It was swept and cleaned up for a 0.5-mile radius by EOD personnel in 1976, and was swept at least at two additional times by 1979. The range was fully closed in 1979.

The IAS concluded that based on the extensive cleanup of the area, further study of the site was not warranted.

1.2.2.2 Environmental Baseline Study

As a result of the property transfer of the Former NASD to Puerto Rico, an EBS was conducted to disclose factual relevant information regarding the environmental condition of the Former NASD. The EBS was prepared based on information obtained by record reviews, interviews, site reconnaissance, and aerial photographic review.

In general, the records search and interviews were consistent with the IAS. Additional investigations at the site included an aerial photographic review. The aerial photographic review involved evaluation of 12 aerial photographs dating from 1937/1938 to 1999 by a firm specialized in the analysis of aerial photography. The aerial photographic analysis was used to:

- Track the history of site operations from pre-Navy occupation to present
- Identify Photo Identified (PI) sites; (e.g. ground scars, cleared areas, debris piles, possible disposal areas, etc.) for further follow-up investigations

The aerial photograph survey of SWMU 4 indicated 10 PI sites, including one potential trench and five ground scars. Figure 1-3 provides a location map of the PI sites identified for SWMU 4.

1.2.3 Previous Investigations at SWMU 4

Although no hazardous releases from the OB/OD site were documented, and although records had indicated the site was swept and cleaned by OE personnel, the Navy decided to investigate the site as part of the Installation Restoration (IR) program. The site was designated SWMU 4 at that time.

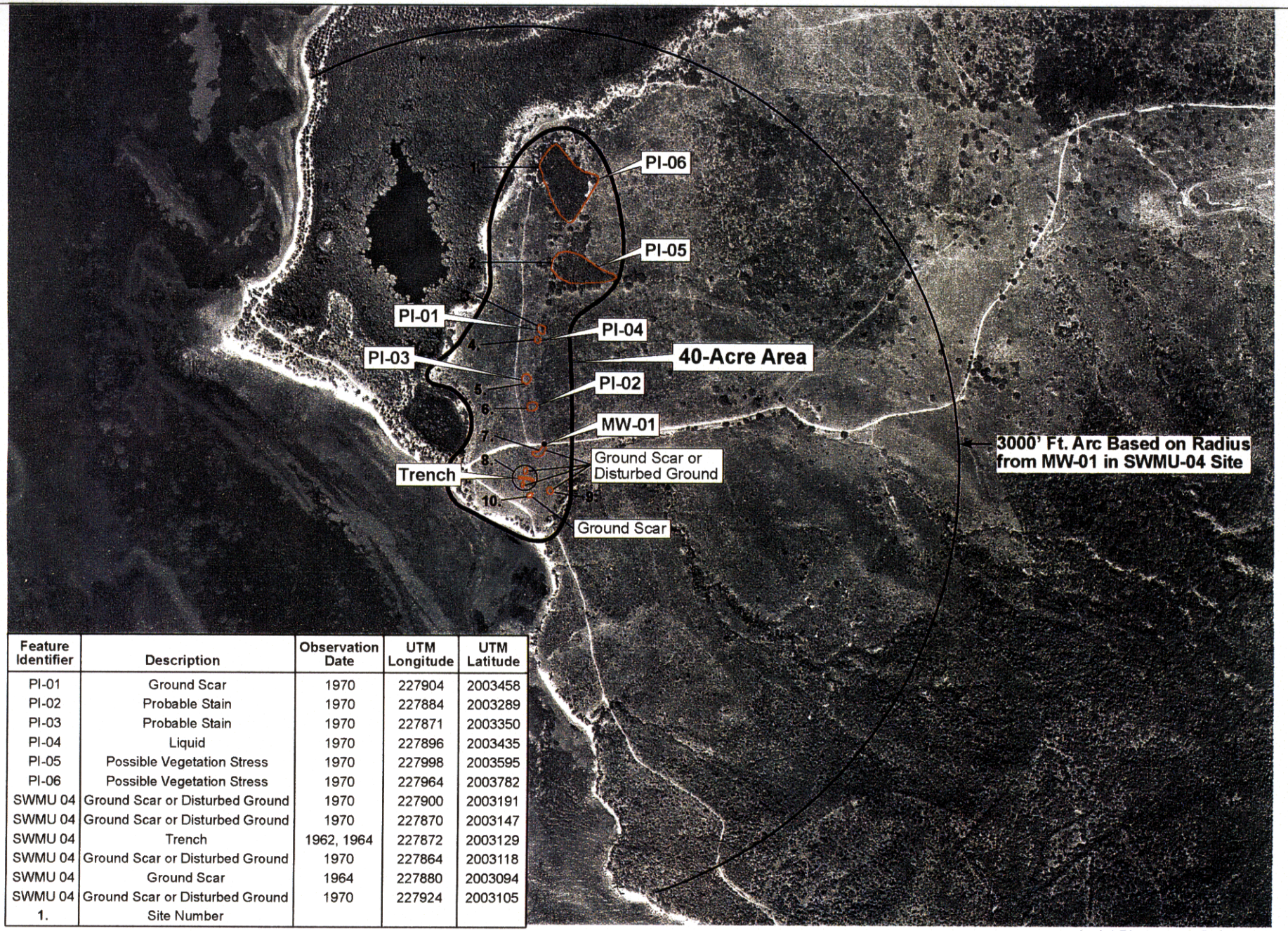
Initial investigations at the site were conducted in April 2000, and included an Expanded Preliminary Assessment/Site Investigation (PA/SI). A second phase of the PA/SI was conducted in June 2000. During the PA/SI, surface and subsurface soil and groundwater samples were collected for laboratory analysis. Results of that effort indicated that explosive-derived constituents were present in surface soils at concentrations above residential risk-based concentrations (RBCs) and soil leachability criteria. Results of the PA/SI were presented in the Phase I PA/SI Report for the Former NASD (CH2M HILL, October 2000).

As part of the PA/SI efforts at SWMU 4, a UXO avoidance geophysical survey was completed to clear the locations of soil borings and monitoring wells of potential UXO. In addition, the access roads to the sampling locations were cleared of UXO. A Schonstedt fluxgate magnetometer was used to identify potential UXO near the soil boring and monitoring well drilling sites to a depth of 2 ft. A down-hole magnetometer was used during the drilling process to check for potential UXO every 2 ft to a depth of 10 ft.

Additionally, transects were cut through the brush to identify the potential locations of the OB/OD pits. An EOD technician cleared the area in front of the bulldozer during the brush clearing for each transect. The technician performed a sweep with the Schonstedt magnetometer and identified UXO items. After the transects were cut, a conventional magnetometry survey was conducted along the transects and pads to identify potential

areas of buried metal. Figure 1-4 shows the locations of OE items found along the transects and roads, and also shows potential magnetic anomalies from the magnetometer survey.

A total of 61 OE items were found, including 37 20-mm high explosive (HE) projectiles, 16 MK-230 fuses, five small arms, one 60 mm mortar fuse, one electrical blasting cap, and one auxiliary booster. Several of the OE items were identified along a transect that extended along the center of the 40-acre area where the OB/OD area was suspected to be located. The OE items detected were removed by the EOD technicians and disposed of by Navy EOD personnel.



Feature Identifier	Description	Observation Date	UTM Longitude	UTM Latitude
PI-01	Ground Scar	1970	227904	2003458
PI-02	Probable Stain	1970	227884	2003289
PI-03	Probable Stain	1970	227871	2003350
PI-04	Liquid	1970	227896	2003435
PI-05	Possible Vegetation Stress	1970	227998	2003595
PI-06	Possible Vegetation Stress	1970	227964	2003782
SWMU 04	Ground Scar or Disturbed Ground	1970	227900	2003191
SWMU 04	Ground Scar or Disturbed Ground	1970	227870	2003147
SWMU 04	Trench	1962, 1964	227872	2003129
SWMU 04	Ground Scar or Disturbed Ground	1970	227864	2003118
SWMU 04	Ground Scar	1964	227880	2003094
SWMU 04	Ground Scar or Disturbed Ground	1970	227924	2003105
1.	Site Number			

Aerial Photograph Date: 1967

N

Scale in Feet

0 1500 3000

Figure 1-3
Photo-Identified Ground Scar Locations
Former NASD, Vieques Island, Puerto Rico

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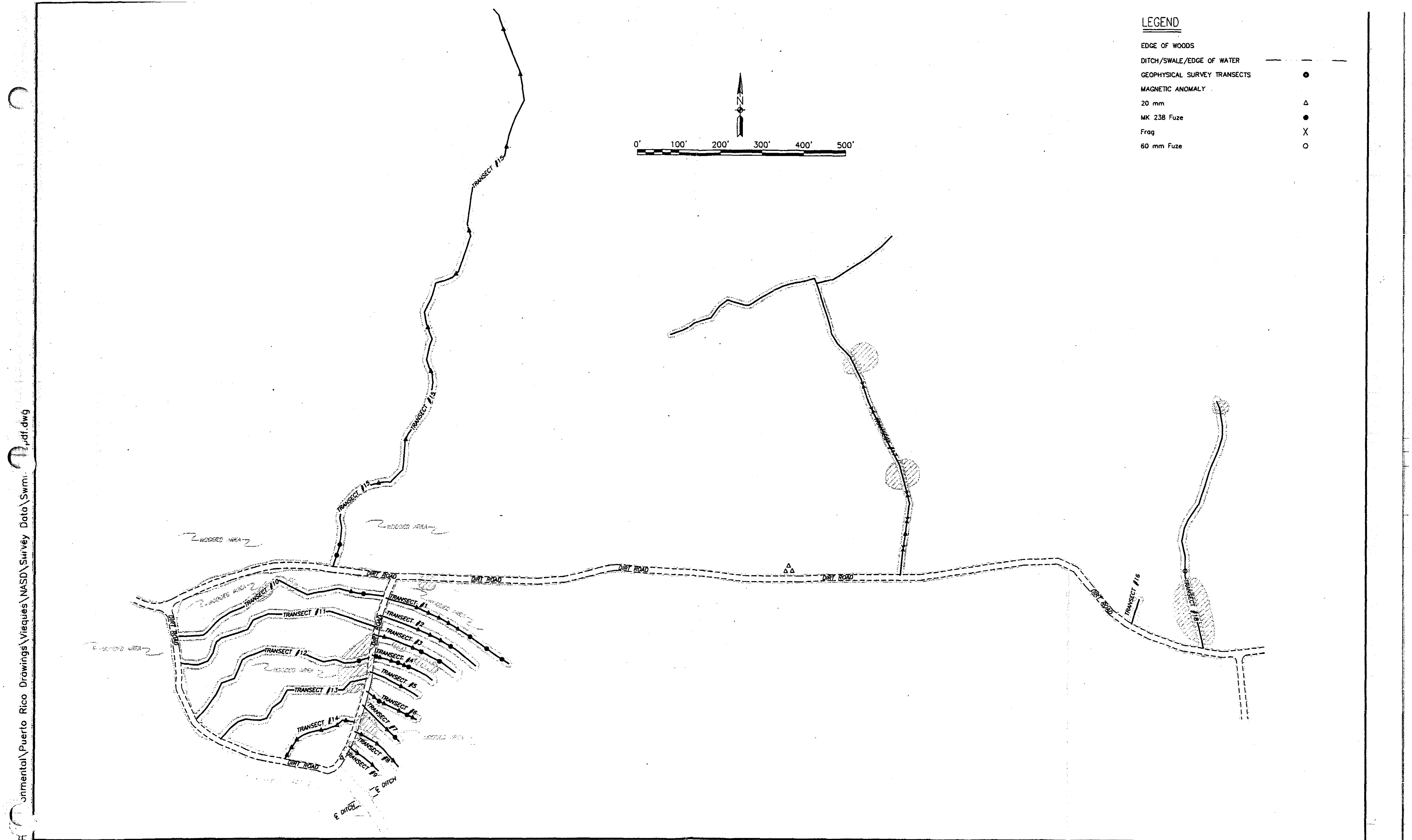

Figure 1-4
SWMU-04 UXO Avoidance and Geophysical Investigation
Former NASD, Vieques Island, Puerto Rico

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SECTION 2

Technical Management Plan

2.1 General

The general approach of the Technical Management Plan is discussed in Section 2 of the *Draft Final Ordnance and Explosives (OE) Master Work Plan,* U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico (CH2M HILL, October 2001).

Activities will be conducted in accordance with the *Draft Final OE Master Work Plan* and the *Site-Specific OE Work Plan for SWMU 4* as applicable. Specific work task Standards of Practice (SOPs) will be provided by the geophysical and UXO subcontractors. Refer to Figure 2-1 for the Project Organization Chart.

The purpose of this site-specific plan is to provide procedures not addressed in the *Draft Final OE Master Work Plan.* The primary consideration of this plan is the protection of human health and the environment.

2.1.1 Project Field Communication

Figure 2-2 depicts the line of communication for the SWMU 4 UXO field investigation according to the chain of command described below. The subcontractors, USA Environmental and Blackhawk Geometrics, will report directly to CH2M HILL field personnel. USA's Senior UXO Supervisor will report directly to Field Superintendents (FS), Erik Isern or Fernando Ferreira. The Site Geophysicist will also report directly either to Erik Isern or Fernando Ferreira.

The FSs will coordinate with the geophysics subcontractor and will report directly to the Project Manager (PM), Marty Clasen.

The PM, Marty Clasen, will coordinate with CH2M HILL UXO Manager, Ben Redmond, and Quality Control (QC) Supervisor, John Tomik, for senior technical advice. Marty Clasen will report directly to Chris Penny, LANTDIV Remediation Project Manager (RPM).

The LANTDIV RPM, Chris Penny, works individually with Ben Redmond and John Tomik, and will report significant findings, if necessary, directly to Rick Urbanski of the Naval Ordnance Safety and Security Activity (NOSSA).

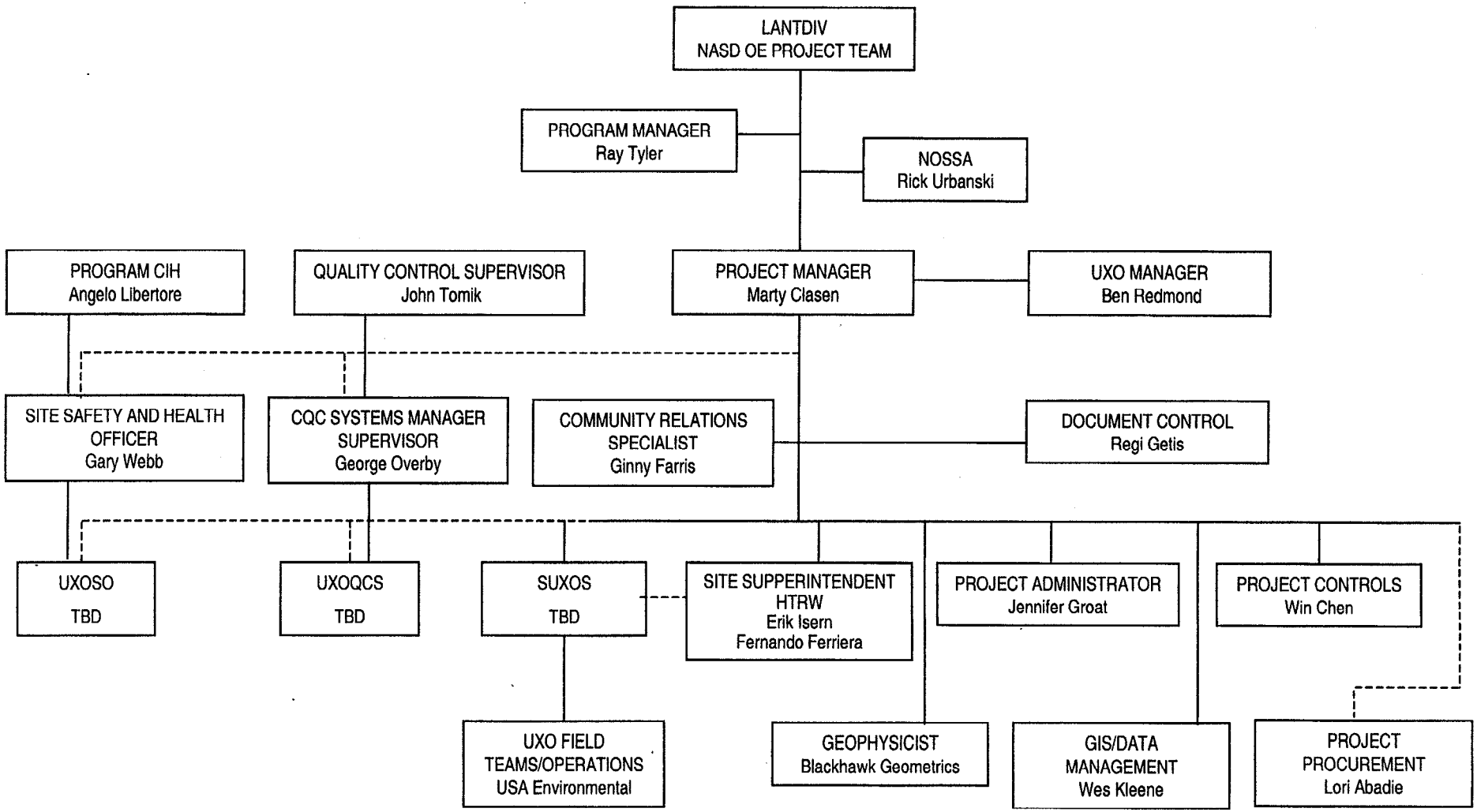

FIGURE 2-1
PROJECT ORGANIZATIONAL CHART
FORMER NASD VIEQUES
PUERTO RICO

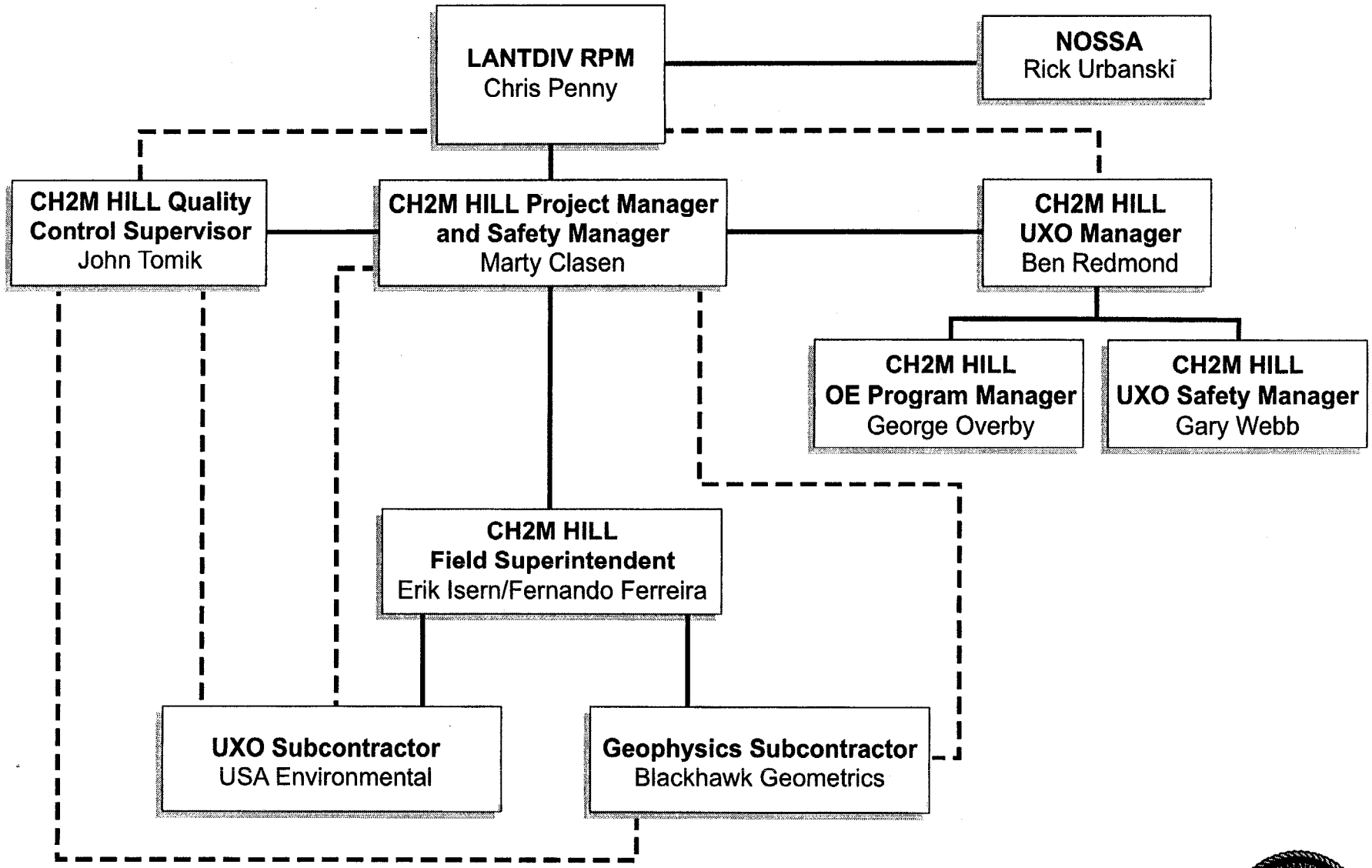

FIGURE 2-2
Ordnance and Explosives (OE), SWMU 04
Project Field Communication Plan

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2.1.2 Field Decision Making Process

This section describes the actions to be taken in the field regarding the field investigation process, as shown on Figure 2-3.

The chain of command for the field activities is as follows:

The FS, Erik Isern or Fernando Ferreira, will be the direct supervisor for the subcontractors. All activities will be channeled by them to the CH2M HILL PM, Marty Clasen. Senior technical advice to the PM will be provided by John Tomik, QC Supervisor, and Ben Redmond, UXO Manager. The PM reports to the LANTDIV RPM, Chris Penny, who in turn will update significant UXO activities, if necessary, to Rick Urbanski and Ed Klinghoffer of NOSSA.

USA Environmental will perform the visual sweep of the SWMU 4 area, along the access roads, and in the walkable portions of the vegetated area along the roads. If UXO is not found during the visual sweep, then USA Environmental will report to one of the FSs. The FS will report to the CH2M HILL PM, Marty Clasen, who in turn will report to the LANTDIV RPM, Chris Penny. If UXO is found while performing the visual sweep, the following course of action will be taken:

The FS will notify the USA Environmental Senior Supervisor and he will determine if it is safe to remove the UXO to a designated secure area for disposition. If the UXO is not safe to remove, the CH2M HILL PM will be notified immediately of the situation. If the UXO found is not safe to move, it will be blown in place. If an unknown UXO item is found, the NSRR EOD team will be called for an emergency response. The NSRR EOD team will determine the course of action for an unknown UXO item. If the EOD Team determines that removal of the UXO is safe, the FS will notify the PM of the decision by the EOD Team.

The geophysical contractor in charge of the geophysical survey of the area will be Blackhawk Geometrics. If no anomalies are found, Blackhawk Geometrics will report to the FS and the chain of command will be initiated as described above. If anomalies are encountered while surveying the area, the FS will be notified by Blackhawk Geometrics and the FS will notify the PM. The area where the anomaly was encountered will be verified by USA Environmental. If no UXO is found, USA Environmental will report to the FS, and up the chain of command. Upon notification of the EOD Team, the CH2M HILL PM will be contacted immediately.

2.1.3 Blow-in-Place Decision Tree

The following is a description of the chain of command that pertains to the process of disposal of UXO by the blow-in-place flow chart shown in Figure 2-4.

The USA Environmental UXO Team, headed by the Senior UXO Supervisor, determines if the UXO is safe to move. He notifies the CH2M HILL PM if he determines that the UXO is unsafe to move and that a blow-in-place must be performed.

The USA Environmental UXO team will determine the extent of the exclusion zone and the relative risk of UXO on SWMU 4. If there is a high risk of UXO, the option to be used is the blow-in-place. The investigation will be stopped while the appropriate institutional controls

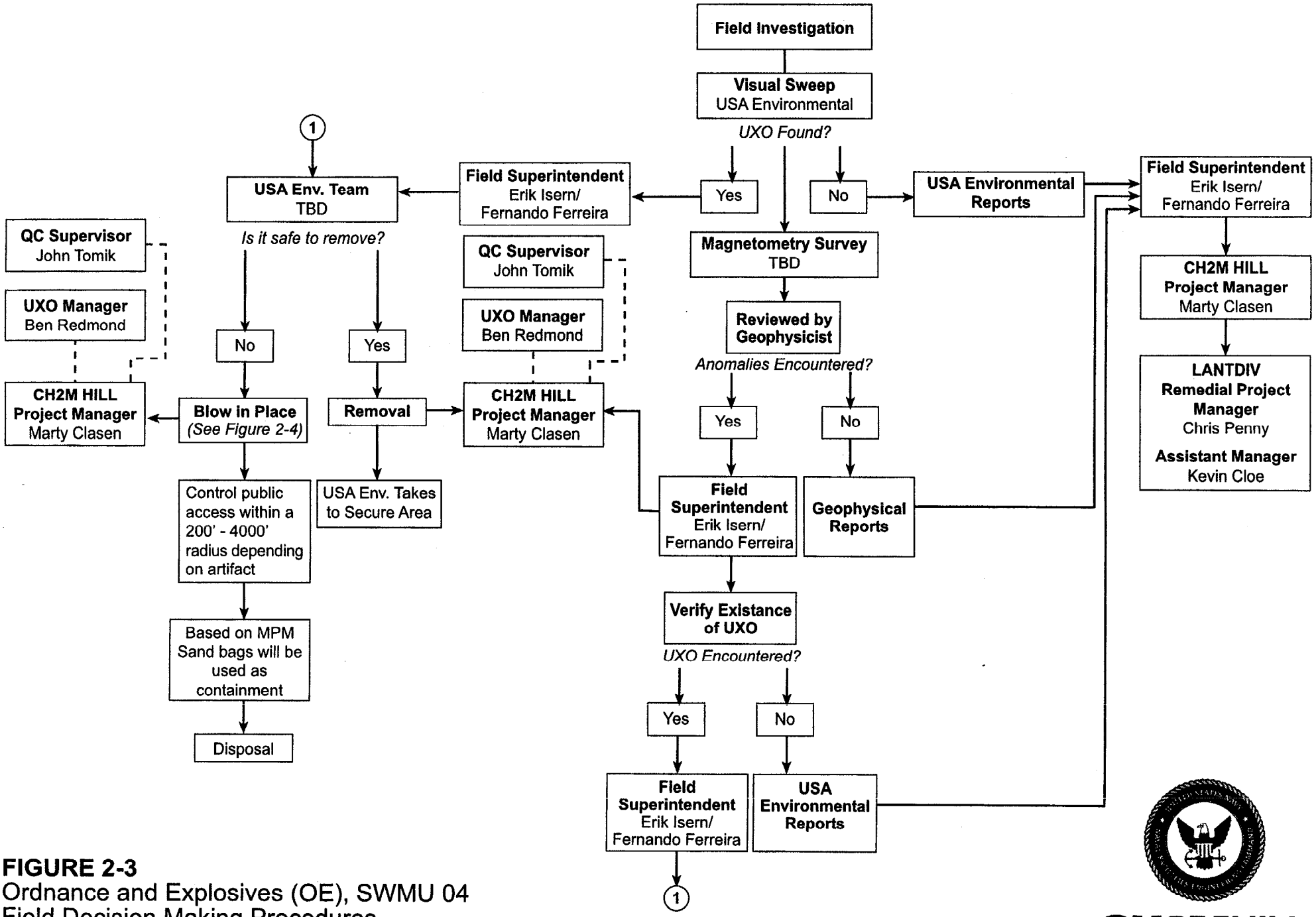

FIGURE 2-3
Ordnance and Explosives (OE), SWMU 04
Field Decision Making Procedures

CH2MHILL

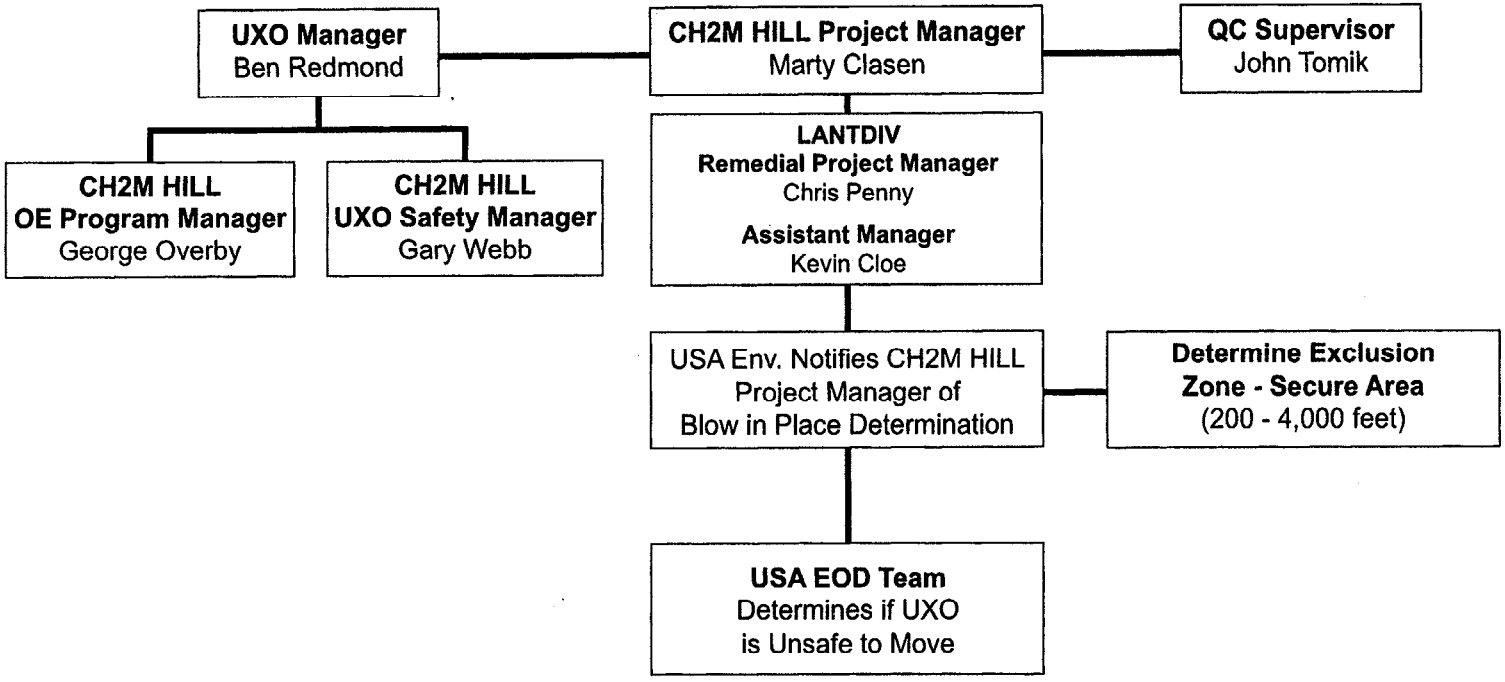

FIGURE 2-4
Ordnance and Explosives (OE)
Blow in Place Decision Tree

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are instituted. Depending on the situation, engineering controls may not be required since OE items will either be blown in place or consolidated in an accumulation area for daily or weekly detonations. The gate at the entrance of SWMU 4 will be closed to traffic, limiting access to authorized personnel only.

2.2 Site Approach Methods

The site approach method for sampling and investigation of the areas of concern was selected at the Site Approach Meeting for SWMU 4 on June 20, 2001. The Site Approach working group consisted of representatives from LANTDIV, NOSSA, Ordnance Environmental Support Office (OESO), and CH2M HILL OE staff.

The meeting resulted in an agreement for investigation methods listed in Table 2-1 and presented in this Site-Specific Work Plan.

TABLE 2-1
Project Sites and Associated Sampling Approaches

Site	Estimated Acreage	Site Approach	Sampling Methodology
SWMU 4*	25	Remedial Investigation of 12.5 percent of the 200 acre site (approximately 25 acres), survey grids, vegetation removal, surface OE clearance, digital geophysical mapping survey, UXO intrusive investigation to 1 ft bgs.	100 percent digital geophysical mapping survey of selected sites

Notes:
bgs below ground surface
RI Remedial Investigation
*Inactive OB/OD, the primary release mechanism is either residual OE remaining onsite, kick-outs from explosions, poor housekeeping, mishandling or misplacement of items in the area.
The investigation approach for these sites is a digital geophysical mapping survey extending for a 100-ft square grid from the center of the suspected sites.

2.2.1 Recommended Approach

The recommended site approach is as follows:

- Locate and map sites previously identified; 10 points of interest.
- Survey and flag sites, OE avoidance required.
- Evaluate vegetation removal options and tree removal, ecological issues with DoI.
- Conduct surface clearance of site before vegetation removal for each PI site. The vegetation removal method may vary from site to site.
- Conduct vegetation clearance in a 100-ft square grid from the center of the points of interest, in accordance with *Draft Final OE Master Work Plan*, Section 2.2.8, and this *OE Site-Specific Work Plan*, Section 2.2.3; OE avoidance required.
- Initiate surface OE/UXO and scrap metal clearance in accordance with *Draft Final OE Master Work Plan*, Section 2.2.7.

- Initiate the digital geophysical mapping survey at each of the 10 points of interest identified from the historical aerial photos, previous investigations and site reconnaissance.
- Conduct a full coverage (100 percent) digital geophysical mapping survey to radial distance of 100 ft from the center of the points of interest.
- Complete the anomaly analysis as discussed in the *Draft Final OE Master Work Plan*, Section 2.2.13, and the sub-contractor SOP.
- Conduct the anomaly reacquisition, validation and excavations as discussed in the *Draft Final OE Master Work Plan*, Sections 2.2.14 and 2.2.15, and the sub-contractor's SOP.
- Extend the radius of the survey if OE is discovered beyond the 100-ft square grid.
- Close out.

Based on the results of the digital geophysical mapping survey, a Phase II OE removal plan will be developed. The Phase II plan will include an approach for identifying and removing the OE for the area inside the 40-acre parcel. The approach will include a contingency that if high concentrations of OE scrap are detected near the perimeter of the 40 acres (suggesting that OE may extend outside the 40-acre area), then an additional geophysical survey appropriate for large densely vegetated areas, such as an aerial survey, should be completed. The scope of the aerial survey should be included as an optional task for NOSSA to review.

2.2.2 Mobilization

The field office will be established as indicated in the *Draft Final OE Master Work Plan*, Section 2.2.4.3, and at the location indicated on Figure 2-5.

2.2.3 Site-Specific Training

Designated PMs and supervisors will provide and document site-specific training during the project site kickoff meeting and whenever new workers arrive onsite. No site workers will be allowed to begin work onsite until the site-specific training is completed and documented. As part of the site-specific training, the following topics shall be covered:

- Work Plan, Health and Safety Plan, Environmental Protection Plan
- Field operations
- Potential OE contact, including recognition and identification of the hazards of UXO
- Exclusion zones
- Communication systems
- Symptoms of chemical exposure
- Chemical, physical, and toxicological properties of the site contaminants
- Hazard communications
- Sampling and sampling equipment
- Emergency recognition, prevention, and emergency evacuation
- First aid/CPR and blood-borne pathogens

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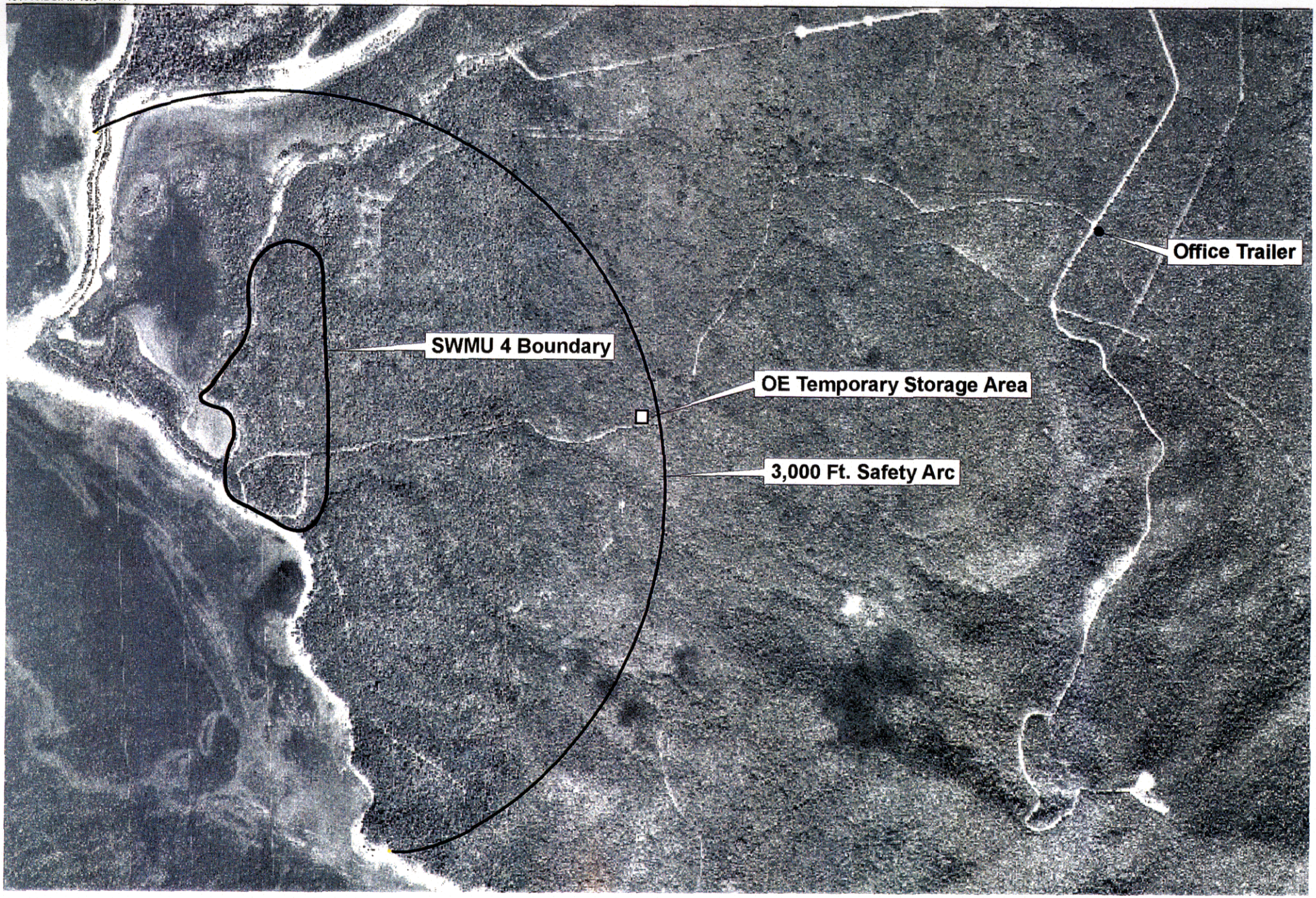

Aerial Photograph Date: 1994

N

Scale in Feet

0 1500 3000

Figure 2-5
Project Trailer Location
Former NASD, Vieques Island, Puerto Rico

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2.2.4 Vegetation Removal and Disposal

Vegetation removal on SWMU 4 will be conducted by mechanical means using Timberline equipment and the Standard Manual Vegetation Clearance as indicated in Section 2.2.8 of the *Draft Final OE Master Work Plan*. Any restrictions on vegetation removal activities will be reviewed by the DoI as the local environmental authority.

Because SWMU 4 is heavily vegetated, some degree of manual vegetation clearing is anticipated to be required prior to conducting geophysical surveys or anomaly excavation operations. Site clearing operations will be completed prior to start up of activities to avoid time delays in conducting UXO geophysical survey efforts.

2.2.4.1 Team Composition

The basic vegetation removal team consists of an UXO Technician III and a UXO Technician II. The basic UXO team can be augmented with up to five non-UXO-qualified laborers for hand cutting vegetation. The laborers will use hand tools that are appropriate for the vegetation being cut, such as chain saws, heavy-duty power weed whackers, and machetes to cut the vegetation.

2.2.4.2 Initial Sweep

As the first step, the UXO technicians will carefully inspect all areas of the grid ahead of the laborers with the aid of Schonstedt GA-52CX magnetometers (or equivalent). The UXO Technicians will mark any UXO or other hazards by encircling the hazard with flagging tape. The laborers will be instructed to avoid working in designated areas. If UXO is discovered on the surface, mechanical equipment will not be used unless the area can first be effectively swept of all surface UXO.

2.2.4.3 Vegetation Disposal

The cut vegetation will be mulched in place using the Timberline equipment. A typical method of vegetation disposal is chipping the vegetation into mulch, which is then spread over the cleared area to serve as seeding of native plants, ground cover, and soil nutrient. If a significant amount of poison oak is present, chipping will not be performed.

2.2.4.4 Grass and Brush Clearance

Grass or brush clearance will be accomplished with gas-powered string trimmers with saw blade attachments, or where appropriate, a tractor equipped with a bush hog mower. The brush will be cut to a height of no greater than 6 inches above ground surface to eliminate interference with UXO detection or survey activities.

2.2.4.5 Tree Trimming or Removal

Trees will be trimmed or removed on a case-by-case basis and only as required to accomplish the project tasks in the scope of work (SOW). If removal is required, the tree will be cut using chain saws. The tree will be sectioned, if necessary, to remove it from the immediate area, so it does not interfere with OE/UXO detection or survey activities. Qualified CH2M HILL ecologists will conduct a site reconnaissance of the proposed work area prior to tree trimming or removal activities to identify and flag any biota that may be Federally protected species. CH2M HILL will use responsible judgement to avoid cutting trees larger than 3 inches in

diameter unless absolutely necessary, and to avoid removal of hardwoods if possible. Trees will be felled into an area that has already been surface swept for UXO.

2.2.4.6 Safety Hazards

Appropriate Personal Protective Equipment (PPE) will be worn according to Section 6, Site Safety and Health Plan. Certain vegetation, such as small-diameter trees and solid stalk plants, will be cut parallel to the ground and as close to the ground as possible to avoid impaling hazards in the event that someone falls on the remaining stalk.

The vegetation that is removed will either be mulched in place or placed in a staging area or clearing where it will be mulched or chipped. When the survey is completed, the mulch will be spread via mechanical means over the entire cleared area as a ground cover. Special considerations will be given to protecting the habitats of the nesting turtles and the Cobana Negra tree as specified in Section 10, Environmental Protection Plan, of the *OE Draft Final Master Work Plan*.

2.3 Digital Geophysical Mapping Survey

Sections 2 and 5 of the *Draft Final OE Master Work Plan*, this Site-Specific Work Plan, and the geophysical subcontractor SOPs discuss the procedures used to acquire geophysical data, process the data, and select potential UXO targets.

2.4 Intrusive Investigation

For each specific site, all anomalies evaluated as potential UXO will be selected for intrusive investigation. The targets will be reacquired using a differential global positioning system (DGPS) in conjunction with an appropriate reacquisition instrument, and excavated by hand. Prior to the start of field operations, the DGPS will be set up and tested to ensure accurate and consistent operation. The personnel, vehicles, equipment, and mobilization/demobilization tasks required for completion of the intrusive aspect of the field investigation are described in the following subsections. Section 2 of the *Draft Final OE Master Work Plan*, a detailed SOP for intrusive sampling, will be provided by the UXO Subcontractor.

2.4.1 Selection of Equipment and Personnel (Magnetometer and EM-61)

Detection equipment used for OE/UXO avoidance and reacquisition will be selected by the OE/UXO subcontractor. Equipment will be validated through a geophysical proveout. Because all ordnance targets are expected to contain at least some ferrous materials, verification of the removal of a target from an excavation will be performed using equipment designed to detect primarily ferrous materials. All detection equipment will be transported by air cargo to Vieques, where it will be inspected for damage and tested prior to the start of field operations. Spare equipment and accessories will also be mobilized to minimize downtime.

Radios will be available for communication with the site office and other personnel. Radios shall not be used within 100 ft of located OE/UXO or demolition operations as per NAVSEA OP 3565, Electromagnetic Radiation Hazards for Ordnance.

2.4.2 OE/UXO Disposal

Disposal actions to be taken for OE/UXO recovered during investigative operations will generally fall into one of the following three categories:

2.4.2.1 Recovered UXO

The UXO recovered during the investigation will be documented, removed, and transported by USA Environmental to an authorized magazine storage facility or a safe holding area onsite.

Subcontractor UXO technicians will provide ordnance disposal support services upon request from the Navy Technical Representative (NTR).

When OE that cannot be moved safely is discovered, and the area can withstand a high-order detonation, then the item will be blown in place.

Engineering controls or protective measures will be employed where required to minimize the damage from blow-in-place operations. These controls may consist of earthen works, sandbags, trenching, buttressing, taping of glass, mounding, flooding, and venting to reduce the effects of detonation.

2.4.2.2 Recovered Ordnance-Related Scrap (ORS)

ORS – Ordnance related scrap materials that have been in direct contact with energetic materials of the ordnance (e.g., expended rocket motors, shell casings, and warhead fragments) will be visually inspected by at least two UXO personnel, and will be certified free from energetic materials that would pose an explosive safety hazard, if appropriate. Certified safe ORS will be containerized and disposed of in an approved landfill as uncontaminated metal debris or sent to a Defense Reutilization and Marketing Office (DRMO) authorized recycle facility. Materials that cannot be certified as safe from explosive hazards will be handled, stored, transported, and disposed of as OE by UXO personnel. Appendix A details ordnance-related scrap metal collection and inspection procedures.

Recovered Non-OE Scrap

Non-OE Scrap – Metal debris that is not ordnance-related (e.g., rebar, angle iron, and sheet metal) is not classified as hazardous waste and will be consolidated at the site in a separate roll-off container. It is anticipated that non OE-related scrap will be disposed of at the NSRR DRMO facility.

2.4.3 Exclusion Zones

A restricted/exclusion zone (EZ) shall be established around the area where intrusive activities are conducted, in accordance with Section 6 of this plan. Initially, a 300-ft EZ will be established at each location where intrusive activities are being conducted. If OE/UXO is located during excavation, the EZ will be adjusted to 1,250 ft for non-fragmenting explosive materials; 2,500 ft for fragmenting explosive materials; or 4,000 ft for bombs and projectiles of caliber 5-inch and greater. While UXO operations are in progress, only those personnel necessary for the operation will be allowed within the EZ. If nonessential personnel enter the area, all UXO operations will cease.

SECTION 3

Explosives Management Plan

This section describes the site-specific aspects of the explosives management plan for SWMU 4, and was developed to supplement the general approach of the explosive management plan as discussed in detail throughout Section 3 of the *Draft Final OE Master Work Plan*. The explosives management plan will be implemented in accordance with the appropriate components of the *Draft Final OE Master Work Plan* and this SWMU 4 Site-Specific OE Work Plan as applicable.

3.1 Acquisition

CH2M HILL is prepared to acquire commercial explosives from an explosive vendor(s) who will deliver the materials to the project site for OE/UXO demolition purposes. CH2M HILL maintains a licensed Bureau of Alcohol, Tobacco, and Firearms (ATF) user with a high explosives permit, who is available upon request. Explosives vendors cannot supply explosives without the required valid dealer ATF license. A copy of this dealer license will be maintained at the project site, and upon request, will be made available to any local, state, or federal authority. It is expected that the binary explosives will be shipped to Vieques via FedEx eliminating the need to develop a plan for the explosives handling area for arriving explosives.

The types and estimated quantities of explosives and their intended use are specified below. The commercial explosives vendor will be determined by the UXO subcontractor, USA Environmental.

The following explosives will be used during explosive disposal of OE/UXO:

- Main charge high-energy binary explosives that detonate at high velocities will be used to detonate UXO.
- Jet Perforators or similar prepackaged shaped charges will be used to explosively vent hard-cased munitions.
- A detonating cord will be used to construct mainline-branch line shots, to link multiple shots together, or to transmit the explosive train to the main charge explosive when the main charge is buried (tamped), underwater, or otherwise inaccessible.
- Electric and/or non-electric blasting caps may be used as initiators.
- NONEL tubing may be used to transmit the explosive train from the igniter to the demolition devices. Shock tube priming of explosives offers the instantaneous action of electric detonation without the risk of accidental initiation of the blasting cap (and the charge) by radio transmitters in the area, or by static electricity discharge. The explosion of the shock tube is totally contained within the plastic tubing.

3.2 Storage

This section presents the plan for storage of explosives to be used during OE projects at the Former NASD.

3.2.1 Establishment of Explosives Storage Facilities

Explosives will be stored in a temporary portable explosives storage Type 2 magazine as described in Section 55.208(a)(4) of ATF P 5400.7, Explosives Law and Regulations. This portable unit is constructed with separate compartments for initiators (blasting caps) and the binary explosives. Explosives items will be stored in accordance with its Hazard Division (HD) and the storage compatibility group criteria listed in Chapter 3 of DoD 6055.9-STD. The quantity-distance (Q-D) requirements are specified in Table 3-1.

TABLE 3-1
Calculated Fragment and Overpressure Distances Examples

Munition[a]	Hazardous Fragment Distance[b] (ft)	Maximum Fragment Distance[c] (ft)	K50 Over Pressure Distance[d] (ft)
37mm MK II	200	1,181	43
2.36" Rocket (case only)	200	809	43
60mm M49A3	200	1,080	41
81mm M374	234	1,233	70
105mm M1	341	1,939	70
3" Stokes Mortar	219	1,346	68

[a]For Q-D siting purposes, two separate MPMs and resulting EZ distances will be established for NASD Vieques, based on the greatest of the fragmentation or overpressure distances for the types of munitions found during sampling. Fragment hazard distances will be recalculated based on the NEW, in the event different OE items are found.
[b]As calculated by NOSSA/OESO, the distance at which fragments do not exceed a hazardous fragment density of one hazardous fragment per 600 sq ft, where a hazardous fragment is defined as a fragment having an impact energy of 58 ft-lb or greater.
[c]As calculated by NOSSA/OESO, the maximum distance at which a fragment of the munition may travel based on munition design specifications and maximum trajectories.
[d]As calculated by NOSSA/OESO, distance at which blast overpressure exposure from Hazard Division 1.1 explosives is less than 0.90 psi—the lower end of the permissible exposure level for inhabited buildings, administrative and housing areas per Chapter 2, para. D.6 of DoD 6055.9-STD. Determined from the formula: $50 \times NEW^{1/3}$.

The temporary portable explosives storage magazine will be placed on the concrete pad on the apron to the existing earth covered magazine (ECM) 239 near SWMU 4. Three sides of ECM 239 will provide security for the portable magazine. A fence will be constructed on the fourth side to enclose the portable magazine and will be completed with a fence, gate and double lock. Figure 3-1 illustrates the location of ECM 239.

The maximum Net Explosives Weight in pounds (NEW) to be stored in each compartment of the magazine is 50 pounds. This explosives storage area will meet the requirements of:

- ATF P 5400.7 - Alcohol, Tobacco, and Firearms Explosives Laws and Regulations
- DoD 6055.9-STD - DoD Ammunition and Explosives Safety Standards
- DA Pam 385-64 - Ammunition and Explosives Safety Standards
- NAVSEA OP 5 Volume 1, Ammunition and Explosives Ashore

Requirements for the explosives storage area include security locks and fences, placards, and lightning protection systems as described in Section 4.1.1 through 4.1.5 of this document.

3.3 Accountability

Explosives accountability is the responsibility of the Licensed UXO subcontractor purchasing, transporting, storing and using explosives for OE/UXO demolition activities. At a minimum, the following requirements apply:

- Maintain records and reports in accordance with ATF and applicable regulations.
- Retain all records pertaining to explosive materials (i.e., commercial invoices, shipping documents, permits, record books)
- Explosive material physical inventories
- Accountability of explosive material issued, used and disposition
- Date, type of explosives, description/identification of explosives, and quantity
- Records and reports of purchasing, transporting, storing or use of explosives for OE/UXO demolition purposes will be reviewed be CH2M HILL.

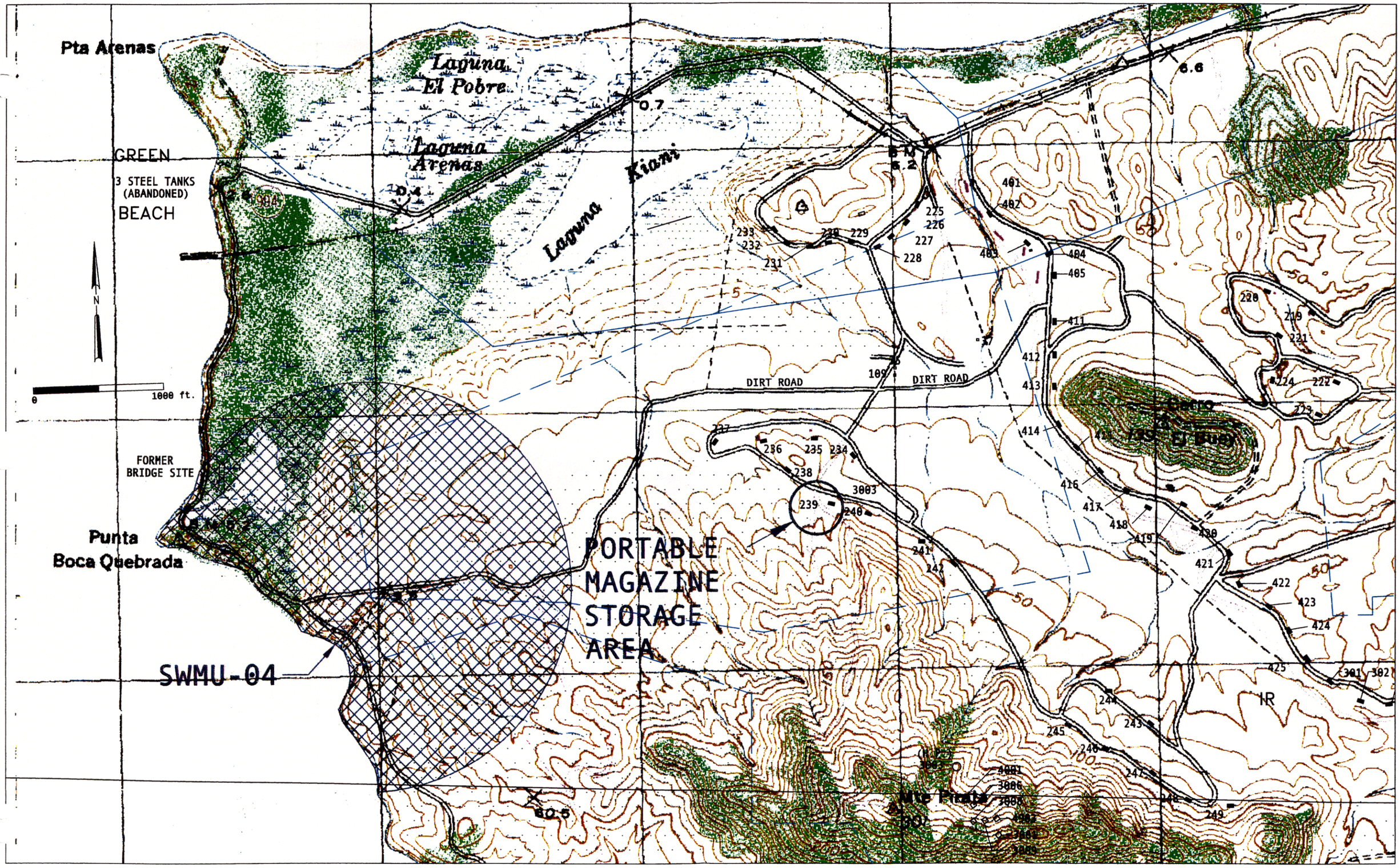

Figure 3-1
LOCATION OF EARTH COVERED MAGAZINE 239
Former NASD, Vieques Island, Puerto Rico

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SECTION 4

Explosives Siting Plan

This section presents the site-specific explosives siting plan requirements for storage of explosives to be used during OE work at SWMU 4. Safety criteria for planning and siting explosives operations were developed in accordance with NAVSEA OP 5 VOL I and OPNAVINST 8020.14. Detailed descriptions on determining EZs, minimum separation distances, and the establishment of demolition areas are presented in Section 4.1 of the *Draft Final OE Master Work Plan*. Table 4-1 in Section 4 of the *Draft Final OE Master Work Plan* summarizes the basic activities that will be conducted in OE areas the basis for determining the appropriate EZ minimum and safe separation distances.

The following subsections present the rationale and strategy for siting a portable magazine at SWMU 4 utilizing the existing concrete apron at ECM 239 to provide magazine security. A separate Magazine Siting Plan will be developed and submitted to NOSSA for review and approval as a supplement to this OE Site-Specific Work Plan.

4.1 Siting of Portable Magazine

The safety arcs for the existing ECMs at the Former NASD have been removed and the magazines have been closed out as part of the transfer of the Former NASD. With their availability limited, USA Environmental will provide a temporary portable Type 2 magazine consisting of two individual compartments for the storage of the initiators and the binary explosives. The initiators and binary explosives will be stored separately in the two individual compartments.

The Magazine Siting Plan to be submitted under separate cover will provide additional detail for the portable magazine including detailed figures illustrating the location of ECM 239, the proposed location of security fencing, and distances to the nearest roads, buildings, and other facilities. Safety Arcs for inhabited buildings and public traffic routes are illustrated in Figure 2-2 of the Magazine Siting Plan.

4.1.1 Physical Security

The concrete pad adjacent to ECM 239 to be used for the storage of the temporary portable magazine will be completed with a new chain-link fence, gate, and two separate locks that meet the standards for ATF Type 2 magazines, as specified in Section 55.208(a)(4), ATF P 5400.7. The SUXOS will hold a key to one of the locks, and the UXOSO will hold the key to the other lock. Access to the explosives will require both individuals. CH2M HILL will maintain control of all keys.

4.1.2 Placards

The temporary portable magazine will display the placards required by OP 5, for the appropriate hazard division and class. A hazard identification for fire fighting personnel

will also be displayed at the magazine storage area. Signs stating "EXPLOSIVES" and "NO SMOKING" will be posted on the fence surrounding the magazines.

4.1.3 Lightning Protection System

Because the Former NASD is located under the management of the DOI, the requirements of Chapter 7 of DoD 6055.9-STD apply. These requirements specify a lightning protection system (LPS) for the explosives magazines. The LPS will be designed to intercept lightning at a 100-ft or less striking distance arc in accordance with National Fire Protection Association (NFPA) 780. The LPS will be inspected, repaired as necessary, and tested prior to receiving the first shipment of explosives. It is expected that existing grounding units inside ECM 239 will be utilized to ground the portable magazines proposed for storage inside of the ECM.

4.1.4 Fire Protection

Fire extinguishers of 10 pounds and type BC will be located in the magazine area. Type BC fire extinguishers are intended for use for electrical or fuel fires. Smoking, matches, open flames, spark-producing devices, and firearms will not be permitted within 50 ft of the magazines. The land surrounding the magazines will be kept clear of all combustible materials for a distance of at least 50 ft.

4.1.5 Stocking Procedures

Containers of explosive materials are to be stored so that marks are visible. Stocks of explosive materials are to be stored so that they can easily be counted and checked upon inspection. Except with respect to fiberboard or other non-metal containers, containers of explosive materials are not to be unpacked or repacked inside a magazine or within 50 ft of a magazine, and must not be unpacked or repacked near other explosive materials. Containers of explosive materials must be closed while being stored.

Tools used for opening and closing containers of explosive materials are to be constructed of non-sparking materials, except that metal slitters may be used for opening fiberboard containers. A wood wedge and a fiber, rubber, or wooden mallet are to be used for opening and closing wood containers of explosive materials. Metal tools other than non-sparking transfer conveyors are not to be stored in any magazine containing high explosives.

4.2 Footprint Areas

4.2.1 Blow-in-Place

Blow-in-place occurs when an OE item is deemed unsafe to move. In this case, the item is prepared and detonated in-place. Minimum separation distances for blow-in-place are based on the criteria for planned or established demolition areas, as discussed in Section 4.1.2 of the OE Master Work Plan.

4.2.2 Collection Points

Collection points are areas within a search grid where recovered OE that is safe to move is temporarily accumulated pending transport to another area for storage or destruction. EZs for collection points are based on the criteria for unintentional detonations as discussed in Section 4.1.1 of the *Draft Final OE Master Work Plan*, using the MK 230 fuze as the MPM for the area. In addition to the MK 230 fuze, 20 mm HE projectiles are also expected to be found at SWMU 4 based on results of the UXO avoidance survey conducted at the site during the PA/SI efforts.

As these projectiles are identified and deemed safe to move, they will be moved to an accumulation area consisting of a sandbagged area covered by plywood. It is anticipated that an area previously used for storage of items found during the Green Beach UXO clearance project will be utilized for the temporary storage of safe-to-move items such as the MK 230 fuze and 20 mm HE projectiles. This accumulation area is within the SWMU 4 limits and is protected by two fenced-in areas with locks. The proposed accumulation area for OE deemed safe to move is illustrated in Figure 2-5.

It is anticipated that accumulated safe-to-move ordnance will be blown in place once per week depending on the amount of items recovered.

SECTION 5

Geophysical Investigation Plan

This section provides site-specific details of the geophysical investigation planned for SWMU 4 as part of OE activities at the site. The general approach to geophysical investigations is discussed in detail in Section 5 of the *Draft Final OE Master Work Plan*. Activities will be conducted in accordance with the *Draft Final OE Master Work Plan*, the Site-Specific OE Work Plan for SWMU 4 as applicable, and the geophysical SOP from Blackhawk Geometrics.

5.1 Geophysical Investigation Methods

5.1.1 Equipment

The geophysical survey will be a critical component of the assessment at SWMU 4, because the site presents unique challenges as a result of differences in target type, target depth, physical setting, and background.

5.1.1.1 Geophysical Sensors

Two categories of geophysical sensor technologies will be used for locating OE at SWMU 4: electromagnetic instruments, and magnetometers. Commonly accepted technologies and instruments in these two categories are discussed in Table 5-1. These instruments and their applications are discussed below.

TABLE 5-1
Geophysical Detection Technologies and Instruments

Technology Type	Example Instruments	Data Collection Mode
Electromagnetic Instruments:		
Time-Domain Electromagnetic (TDEM)	Geonics Model EM-61 Geonics Model EM-61 Hand-held (HH) Geonics Model EM-63	Digital
Magnetometers:		
Total Field Cesium Vapor Magnetometer (TFM)	Geometrics Model G-858	Digital
Flux Gate Gradiometer (FGM)	Schonstedt Model GA-52/CX	Analog audio
Vector Gradiometer (VGM)	SENSYS MX Compact	Digital

Time-Domain Electromagnetics. TDEM metal detectors, such as the Geonics EM-61 device, are designed to detect shallow ferrous and non-ferrous metallic objects with very good spatial resolution and with minimal interference from adjacent metallic features. An EM transmitter generates a pulsed primary magnetic field in the earth, which induces eddy currents in nearby metallic objects. The eddy current decay produces a secondary magnetic field measured by the receiver coil of the EM-61. By taking the measurement at a relatively long time after the start of the decay, the current induced in the ground has fully dissipated and only the current in the metal is still producing a secondary field. The responses are recorded and displayed by an integrated data logger.

The system consists of two air-cored, 1-meter (m) square coils. Secondary voltages induced in both coils are measured in mV. The coils are stacked 40 centimeters (cm) apart, with the source/receiver coil ("B" – bottom coil) located below a second receiver coil ("T" – top coil). The EM-61 records a voltage output from both coils (Channel B and Channel T data), as well as a differential (Channel D) that is the calculated voltage difference between the two coils. The bottom coil data is generally most useful for detecting ordnance-size buried metallic objects. Three modes of operation are available:

1) Trailer mode, in which the coils are carried on a wheeled cart

2) Harness mode, in which the operator carries the coils on a shoulder harness

3) Array mode, whereby two coil systems are ganged into an array for high-productivity coverage. The electronics, battery, and an integrated data logger are carried in a small operator backpack.

Spatial positioning of the EM-61 data can be achieved in four separate ways: via GPS, ultrasonics, tick-wheel, or fiducial marks. GPS is the primary navigation choice, and is used when the EM-61 is deployed in the trailer mode or array mode. Once-per-second GPS coordinates are logged that capture the location of the GPS antenna co-located at the center of the EM-61 coil. When GPS is not practicable, an internal survey tick-wheel can be used for both trailer and array mode. In this case, the distances along profile lines are recorded as the sensor(s) are moved forward. Tick-wheels are appropriate as a backup to GPS or when GPS technology is adversely affected by local vegetation/topographic conditions. Navigation via fiducial time marks can be utilized when the EM-61 is deployed in a harness mode while the EM-61 data are recorded at fixed time intervals. In wooded conditions where GPS, tick wheels, and fiducial methods are not practicable, ultrasonic techniques provided via the USRADS technology are utilized, as discussed below.

The EM-61HH, similar to the EM-61, is a TDEM metal detector that uses a single transmitter coil and a single receiver coil. The coils are 18.5 cm in diameter and are located approximately 6 inches above the ground surface, when mounted on the wheel assembly. The EM-61HH can be operated with or without the wheel. Without wheels, the detector is used in a sweeping mode in front of the operator where the detector collects readings at automatic time rates. With the wheel assembly, the operators push the detector in a more controlled in-line operation and position the data via a tick-wheel. In the wheel mode, the data collection rate can be adjusted to collect readings at every 0.1 m or 0.2 m. The EM-61HH records two time-integrated voltage responses, one at an early time and one at a late time during the decay of the secondary magnetic field. The late time data is advantageous

for eliminating responses from very small metallic objects, because their signal will decay in time beyond detection. In general, because of the coil size and design of the instrument, the EM-61HH's near-surface sensitivity to small shallow objects is greater than that of the EM-61, and for larger items at depth it is less. The EM-61HH requires closer survey line spacing than the EM-61 to achieve similar coverage. The line spacing for the EM-61HH should be 1 to 2 ft, depending on the size of the suspected targets. The line spacing would be the only operational change with regard to the grid layout. The functions of the EM61-HH for data collection and data output are identical to the EM-61.

Total Field Magnetometry. Total field magnetic surveys utilize Geometrics Inc. G-858G magnetometers for survey data acquisition and a G-856AX magnetometer for base station measurements. The G-858G, which is an optically pumped cesium vapor instrument, measures the intensity of the earth's magnetic field in nanoTeslas (nT). During operation of the magnetometer, a direct current is used to generate a polarized monochromatic light. Absorption of the light occurs within the naturally precessing cesium atoms found in the instrument's two vapor cells. When absorption is complete, the precessing atoms become a transfer mechanism between light and a transverse radio-frequency (RF) field at a specific frequency of light known as the Larmor frequency. The light intensity is used to monitor the precession and adjusts the RF frequency allowing for the determination of the magnetic field intensity.

The earth's magnetic field, believed to originate in currents in the earth's liquid outer core, varies in intensity from approximately 25,000 nT near the equator (where it is parallel to the earth's surface) to approximately 70,000 nT near the poles (where it is perpendicular to the earth's surface). In the United States, the intensity of the earth's magnetic field varies from approximately 48,000 to 60,000 nT, and has an associated inclination ranging from approximately 58 to 77 degrees.

Anomalies in the earth's magnetic field are caused by *remnant* or *induced* magnetism. Remnant magnetism is caused by naturally occurring magnetic materials. Induced magnetic anomalies result from the induction of a secondary magnetic field in a ferromagnetic material (such as UXO, pipelines, drums, tanks, or well casings) by the earth's magnetic field. The shape and amplitude of an induced magnetic anomaly over a ferromagnetic object depend on the geometry, size, depth, and magnetic susceptibility of the object, and on the magnitude and inclination of the earth's magnetic field in the study area. Induced magnetic anomalies over buried objects such as drums, pipes, tanks, and buried metallic debris and UXO generally exhibit an asymmetrical, south high/north low signature (maximum amplitude on the south side and minimum on the north).

The earth's magnetic field undergoes low-frequency diurnal variations associated with the earth's rotation, generally referred to as magnetic drift. These variations have their source mainly in the ionosphere and their magnitude is large enough to introduce artificial trends in field data. A base station G-856 magnetometer is generally used to monitor and record this drift so that it can be removed from the field data during processing.

During operation of the G-856 magnetometer, direct current is applied to a coil that is wrapped around a sensor bottle filled with a hydrogen-rich fluid. The current temporarily polarizes the protons in the fluid. When the current is turned off, the protons precess about the earth's magnetic field at a frequency proportional to the total magnetic field intensity.

Measurement of the precession frequency, as a voltage induced in another coil, permits the calculation of the intensity of the earth's magnetic field.

G858G magnetometers can be deployed in a variety of configuration form factors. The magnetic survey design used to conduct the geophysical investigation varies according to site-specific objectives and target sizes. Magnetometers can be deployed as sensor pairs or in multiple-sensor arrayed configuration. They can be deployed in a backpack mode where an operator carries a single G858 unit, or in a cart mode where up to eight magnetometers can collect data simultaneously. The most appropriate deployment configuration will be determined on a site-by-site basis, as the objectives of a magnetic survey and expected results are discussed in a Site-Specific Work Plan. However, the following issues and concerns routinely will be evaluated:

- Review existing site surface and subsurface information.
- Evaluate the potential influence of cultural features (e.g., utilities, fences, structures, power lines, etc.).
- Define most appropriate sensor configuration form-factor (backpack or cart-based).
- Define most appropriate sensor navigation method.
- Define any health and safety hazards.

Spatial positioning of the total field magnetometer data can be achieved in three separate ways: via GPS, ultrasonics, or fiducial marks. GPS is the primary navigation choice, and is used when magnetometers are deployed in either the backpack or cart-modes. Once-per-second GPS coordinates are logged that capture the location of the GPS antenna located at the center of the magnetometer array. When GPS is not practicable, a fiducial navigation method is utilized. In this case, the distances along profile lines are determined through capture of time marks as the sensors are moved across known markers. Fiducial methods are appropriate as a backup to GPS or when GPS technology is adversely affected by local vegetation/topographic conditions. In wooded conditions where GPS and fiducial methods are not practicable, ultrasonic techniques provided via the USRADS technology are utilized.

During the survey, the operator will not carry any metal objects (e.g., steel-toe boots, belt, rings, and watches), and his/her speed will not exceed 1.5 meters per second (m/s) (approximately 5 ft per second [ft/s]). The fiducial marker switch will be used at approximate 9-ft intervals to maintain down-line survey control. At the end of each day, data will be downloaded into a PC, backed up on floppy and zip disks, and then supplied to the geophysicist for processing.

Schonstedt Gradiometer. The Schonstedt GA-52 fluxgate gradiometer is a handheld analog magnetometer which detects ferrous objects and ferromagnetic minerals. The Schonstedt GA-72 fluxgate gradiometer is the same instrument as the GA-52, but with a meter display added. Both instruments provide an audible signal representing the magnitude and direction of the local magnetic field. The operator sweeps the instrument back and forth along the ground. Whenever a change (anomaly) in the magnetic field is encountered, the operator notes the change in pitch, and plants a pin flag. This type of UXO detection has therefore been referred to as Mag and Flag. The anomalous signal is the magnetometer response to a secondary magnetic field produced by buried munitions or other ferrous metal.

Fluxgate magnetometers are sensitive to small, near-surface metallic items, which may include "hot" rocks containing magnetic mineralization. These devices have limited capability to detect targets at depth and produce no digital readings that can be archived as part of the administrative record. As such, Mag and Flag operations based on the GA-52 are not considered a primary option for geophysical mapping.

SENSYS Vector Gradiometer. The SENSYS MX Compact gradiometer system is used when conditions require high resolution mapping of small targets to depths of 4 ft or less, or when surveying is to be performed in the vicinity of metal structures such as fences, buried utility lines, or metal buildings. Additionally, gradiometer systems are effective when a large amount of debris and/or ferromagnetic soil is present.

MX Compact contains MAGNEX 120 gradiometers that consists of two magnet-inductors positioned coaxially at distance inside the probe. Both inductors are connected in differential bridge, suppressing the influence of the homogeneous earth field. Magnetic anomalies coming within detection range generate a gradiometric bias, which is transformed into an audible signal, a meter reading, and a variable voltage. The intensity and field direction of the magnetic anomaly are shown as a plus/minus indication on the galvanometer and recorded on the data logger via an analog-to-digital converter.

As with total field sensors, vector gradiometers can be deployed in a variety of configuration form factors. The magnetic survey design used to conduct the geophysical investigation varies according to site-specific objectives and target sizes. Gradiometers can be deployed as sensor pairs or in multiple-sensor arrayed configuration. They can be deployed in a backpack mode where an operator carries a single MX Compact gradiometer, or in a cart mode where between three and 24 gradiometers can collect data simultaneously. In the cart mode, the sensors can be deployed as a push-cart or towed from a vehicle. The most appropriate deployment configuration will be determined on a site-by-site basis, as the objectives of a magnetic survey and expected results are discussed in a Site-Specific Work Plan. However, the following issues and concerns will be evaluated routinely:

- Review existing site surface and subsurface information.
- Evaluate the potential influence of cultural features (e.g., utilities, fences, structures, power lines, etc.).
- Define most appropriate sensor configuration form-factor (backpack, pushcart-based, or tow-vehicle).
- Define most appropriate sensor navigation method.
- Define any health and safety hazards.

Spatial positioning of the gradiometer data can be achieved via GPS. Once-per-second GPS coordinates are integrated within the data logging system that capture the location of the GPS antenna located at the center of the gradiometer array. When GPS is not practicable, a fiducial navigation method is utilized. In this case, the distances along profile lines are determined through capture of time marks as the sensors are moved across known markers. Fiducial methods are appropriate as a backup to GPS or when GPS technology is adversely affected by local vegetation/topographic conditions. In wooded conditions where GPS and

fiducial methods are not practicable, ultrasonic techniques provided via the USRADS technology are utilized.

During the survey, the operator will not carry any metal objects (e.g., steel-toe boots, belt, rings, or watches), and his/her speed will not exceed 1.5 m/s (approximately 5 ft/s). The fiducial marker switch will be used at approximate 9-ft intervals to maintain down-line survey control. At the end of each day, data will be downloaded into a PC, backed up on floppy and zip disks, and then supplied to the geophysicist for processing.

5.1.1.2 Geophysical Proveout

A geophysical proveout will be performed to determine which instrument performs the best at SWMU 4. The test plot will be sited and OE items (or surrogates) placed at depths from 2 inches to 12 inches to represent expected site conditions as nearly as possible. The test plot will be surveyed with an EM-61 and a total field magnetometer. The data for both instruments will be analyzed and submitted for approval by the project manager.

5.1.1.3 Geophysical Navigation Methods

A suite of navigation options is required to effectively collect sensor position data within the wide variety of vegetation and topographic conditions where digital geophysical mapping may be required. Additionally, the range in number, type, and depth of potential UXO at those sites requires navigation accuracy of 20 cm. To respond effectively to the diverse set of navigation needs, four types of navigation technologies are utilized.

- GPS
- Acoustic/ultrasonic methods
- Fiducial methods
- Tick wheels

Global Positioning Systems. Advanced differential GPS technologies provide the sensor locations at half-ft, real-time accuracy. Blackhawk Geometrics will utilize the dual frequency, dual code, Trimble RTK differential GPS for field-mapping applications when satellite visibility conditions are adequate. Additionally, the subcontractor will deploy the single frequency, dual code, Trimble Pathfinder XRS equipped with multi-path rejection technology. This technology is favored in lightly wooded and congested areas where GPS signals are affected by multi-path reflection. GPS technologies offer full integration with geophysical sensors, real-time differential solutions based on either satellite-provided or base station-provided differential corrections, and the "multi-path rejection" capability that enables GPS positioning in tree-covered sites or near buildings.

Several site-specific issues must be resolved before GPS can be used reliably onsite. These include definition of the site-specific coordinate system on all navigation equipment, establishment of a differential GPS base station, establishment of methods to utilize real-time differential corrections over large sites, and complete testing of site-specific considerations.

In addition to mapping geophysical data, CH2M HILL uses GPS for many different UXO mapping-related tasks, including:

- Feature identification: GPS is used to augment geophysical data and improve effectiveness of geophysical mapping through capture of visual observations made during a site walk-over. During this process, GPS plays a key role in position-stamping debris piles, unidentified fences, soil changes, vegetation, burn areas, craters, etc.
- Grid corner locations: GPS is used to mark survey grid corners.
- Target relocation: GPS equipped with targets loaded from the project GIS will be used for target relocation.

When GPS is determined to be appropriate for sensor navigation, the availability of sufficient satellite coverage will be determined prior to deployment to the site. Two factors dictate sufficiency of satellite coverage: the view of the sky from the survey site, and the number and height of GPS satellites above the survey site. Access to a clear view of the sky is affected by tree coverage, proximity to buildings, and topographic features such as cliffs and steep hills. The orbits of the GPS satellites can be readily viewed through use of GPS planning software such as Trimble SATVIZ. By reviewing the satellite availability on a daily basis, optimal survey periods can be defined, and periods of poor satellite visibility can be coordinated with rest times, preventive maintenance, data downloading, and travel.

GPS is used for geophysical mapping by deploying a rover receiver in conjunction with the geophysical sensors. Concurrently, a second receiver is established as a static base station over a known survey point. While the rover unit logs data with the sensors, the base station unit logs data for post-processing.

To achieve the required 20 cm accuracy, differential corrections must be applied to the GPS data. These corrections compensate for slight timing errors in GPS data associated with atmospheric affects on GPS signals. Three sources of real-time differential correction are available, including:

- Coast Guard broadcasts (where available, typically near the coast and major waterways)
- Satellite-based subscription services (such as OMNISTAR)
- Onsite base stations

Acoustic/Ultrasonic Methods. Acoustic/ultrasonic navigation methods represent an accurate alternative for precision sensor location under conditions where GPS is not applicable. In particular, acoustic/ultrasonic methods are used for geophysical mapping under tree canopies where continuous line-of-sight to the GPS satellites is obscured. Blackhawk Geometrics will employ USRADS, manufactured by CHEMRAD. USRADS is an active spread-spectrum system that utilizes pre-placed transponder beacons to survey in wooded areas. The USRADS technology is fully integrated with magnetometer, gradiometer, and electromagnetic sensors and generates data in state plane coordinate systems. The sensor package can be deployed as a backpack, cart-based, or vehicle-towed configuration, and can be used in data collection or target relocation modes. Data can be collected via USRADS for grid, transect, and full converge modes.

Fiducial Methods/Tick Wheels. Fiducial methods and tick wheels represent less accurate navigation methods that can be used in cases where primary navigation methods (GPS and/or ultrasonic technologies) prove impractical. CH2M HILL will only deploy these technologies if the primary methods are not useable. Fiducial methods use a time-marking

procedure to determine the spatial location of the collected data. Using this approach, a series of survey lanes are established over a grid. Flags are placed at the beginning and end of each lane and an operator walks down the lane while the data logger collects sensor readings at a prescribed sampling rate (10 times per second, for example). As the operator walks past the starting and ending points in the survey lane, he or she hits a button on the data logger that places a fiducial time mark in the data stream. By assuming the operator walked in a straight line at a constant velocity, the location of each data point can be estimated. Under good conditions, accuracy levels of 10 cm can be achieved.

Tick wheels employ a methodology similar to that of fiducial markers to determine the location of collected sensor readings. Tick wheels are integrated with a data logger and mechanically programmed to initiate a data recording sequence after a pre-set forward distance is traversed. For example, the EM61 can be programmed to collect data every 1 ft of forward distance. As with fiducial methods, accuracy levels of 10 cm can be achieved if good conditions exist at a site and if the operational assumption of a straight-line path is not violated.

5.1.1.4 Geophysical Survey Modes

A wide variety of survey modes can be utilized to collect geophysical data for the detection, location, and characterization of UXO. These modes include:

- Full surveys
- Grid surveys
- Transects
- Meandering paths
- Hydrid surveys

The most appropriate survey mode is dictated by several factors, including topography, vegetation, and the number, type, and distribution of UXO. Additionally, the most effective survey mode is dependent on the objectives of the survey. For example, if a site is being remediated, then it may be appropriate to conduct a full survey. Alternatively, if a site evaluation is being performed, then random grids, transects, or meandering paths may prove more effective.

Full Coverage Surveys. Full coverage is used when an entire site requires UXO detection, location, and characterization. Under this methodology, the site is evaluated prior to deployment to determine the most effective strategy of data collection. The site data for the Former NASD will be employed to review site conditions, including site topography, vegetation, proximity to structures (pipelines, fences, etc,.), and other site conditions that may affect access or sensor performance. Full coverage can be achieved through deployment of the sensor system in a variety of techniques, including subdivision of the site into a grid mosaic or collection of parallel survey lines. All data traverses are brought into the GIS for verification of full coverage.

Grid Surveys. Grids are used to survey discrete rectilinear parcels either as part of clearance or evaluation activities. Typically square, grids are usually 100 ft on edge (10,000 sq ft or approximately 0.23 acres) or 200 ft on edge (40,000 sq ft or 0.92 acres). If logistically practical, grids are aligned in a north-south/east-west orientation to simplify the processing

of the collected data. Two types of grid surveys can be used; fixed pattern grid sampling and random fixed pattern grid sampling as described below

Fixed Pattern Grid Sampling. Fixed Pattern Grid Sampling is the process where grids are laid out in a pattern on a fixed percentage (often 10 percent) of a sector. Fixed Pattern Sampling is not commonly used since other more random patterns can provide statistically valid results using fewer grids.

Random Pattern Grid Sampling. Random pattern grid sampling uses a statistical approach to place grids randomly throughout a sector. The total area to be sampled is first determined using a statistical process such as UXO calculator. Grid size and shape is then determined based on site terrain, vegetation, and the geophysical instruments to be used. Grids can be any convenient shape, but square or rectangular grids are most often used. Grids do not need to be all the same size and can be as small as 2,500 sq ft, or as large as one hectare in size. Since random sampling grids are placed completely randomly, there can be large unsampled areas within a sector and for this reason, purely random pattern sampling is not recommended.

Transect Surveys. Transect surveys are utilized to evaluate the extent of contamination in a large area through systematic surveying along linear paths. For example, to estimate the extent of contamination associated with a known impact area, transect survey lines can be collected radially outward from the known contamination area. Subsequent analysis can define the approximate limits of the contamination. Similarly, transects can be utilized in a rectilinear pattern to search large areas. These "pattern searches" can be employed to locate large features such as OB/OD sites and landfills, or to statistically evaluate the UXO contamination within a large site. Transect offset patterns and swath widths are dictated by the site-specific objectives of the survey.

Meandering Path Investigations. Meandering path surveys are effective for the statistically evaluation of UXO contamination. Under this approach, semi-random traverses are executed within pre-defined bounds of an investigation site. The operator deploys sensors in a random walk to collect statistically random data from a site. An advantage of the meandering path approach relative to grids or transect surveys is the flexibility afforded to the operator to make minor real-time adjustments in the path to avoid problematic survey areas (trees, bushes, ravines, etc.). As such, this method allows statistical sampling without significant brush cutting. Meandering paths are inherently random and not pre-planned. However, the general area for the survey is defined in the GIS prior to deployment.

Hybrid Sampling Surveys. In order to assure that a sector receives thorough sampling grid coverage, and that areas known or suspected to contain UXO are geophysically investigated, a modified version of random pattern sampling is recommended. In this hydrid approach, grids are placed randomly across the sector as described above. Afterwards, however, approximately 20 percent more grids are placed in biased locations to fill any apparent data gaps. This approach is recommended when sampling grids are used.

Mag and Flag Survey Procedures. Mag and Flag surveys will be performed only when digital geophysical mapping is determined to be impractical or ineffective. The use of Mag and Flag procedures will be determined on a site-by-site basis, and will not be used as the primary methodology for UXO detection.

Mag and Flag surveys will be performed using Schonstedt magnetometers (see Section 5.4.1.1) according to the following procedures:

1. The UXO Technician III will oversee the division of the survey area into 10-ft-wide search lanes, which will allow UXO technicians to perform 5-ft wide sweeps in two passes. Wooden stakes will be driven into opposing ends of the survey area boundary every 5 ft. Surveyor's line will then be strung between opposing stakes to form the easily definable search lanes.

2. Under the supervision of the UXO Technician III, operators will systematically and thoroughly survey assigned search lanes using the highest sensitivity setting of the instrument. The operator will slowly move forward along the search lane, sweeping the instrument from side to side, and making sure the entire width of the search lane is swept. As anomalous areas are encountered, the magnetometer will generate a change in aural tone that is indicative of a metallic object. The operator will further refine the position of anomalous areas by observing the peak aural tones as the magnetometer is moved over the anomalous locations.

3. The operator will place a pin flag in the ground where the aural tone is the highest along intersecting perpendicular sweeps.

4. The operator will continue in this fashion until the search lane is completed.

5. After all lanes are surveyed, the geographical coordinates will be determined and recorded for each pin flag.

5.1.2 Geophysical Team Members and Qualifications

The geophysical survey team will consist of a geophysics survey technician, who will be responsible for the data collection and processing, and one project geophysicist who will be responsible for evaluating the data. Qualifications for Geophysical contractors should be based on experience and the ability to perform the functions in CEHNC DID OE 005-05, CEHNC DID OE 005-07, and the CH2M HILL Work Plan.

5.1.3 Production Rates

Geophysical mapping production rates are highly variable and depend on several factors, including topography, vegetation, site access, proximity of survey area, and weather conditions. Additionally, the selection of the sensor suite (sensor type and array configuration), defined by the expected type, number and distribution of expected UXO and local soil conditions, affects productivity. For example, in open areas with little vegetation, magnetometer systems deployed as ganged arrays can out-perform TDEM sensors in terms of area covered per day.

Another factor that impacts productivity is the mode of survey selected. Full coverage surveys are the most efficient as they require the least set-up time, whereas small grids are less efficient. Specific production rates will be determined on a site-specific basis.

5.1.4 Data Resolution and Data Density

UXO are detected, located, and characterized through the collection and analysis of data containing a geophysical signature of the buried target. The signature must have enough signal strength to allow for clear and unambiguous detection, and must have sufficient signal fidelity to allow for the recognition of the anomaly as potential UXO. As such, the resolution of the target is based on the following factors:

1) The type, number, and expected distribution of potential UXO
2) Existence of possible debris, and/or metal structures that may complicate or obscure the geophysical anomaly
3) The type of sensor deployed
4) The height of the sensor off the ground

Three adjustments to the data collection systems can be made to assure that sufficient data resolution is achieved. First, the sensors can be deployed as ganged multi-sensor arrays with the offset of the sensors adjusted establish sensor spacing. Second, the line-spacing can be adjusted to establish inter-sensor offsets. Third, the data collection rate can be adjusted to increase (or decrease) collection of data in the forward-moving direction. Data collection rates are varied by adjusting the number samples collected per second (for GPS, ultrasonic, and fiducial methods) or by adjusting the spatial data-collection interval of the tick-wheel. The specific data resolution and data density requirements will be established on a site-specific basis.

5.2 Location Surveying, Mapping and Navigation

Section 7, Location Surveys and Mapping Plan, discusses the methods, equipment, and accuracy required for location surveys and mapping. Location/navigation control will occur using the survey control points, internal instrument recorders (survey wheels, timers, etc.), fiduciary control markers, and measuring tapes or measures lanes. All sensor data will be correlated with navigational data based upon a local first-order control point.

5.3 Instrument Standardization

5.3.1 Instrument Drift

Geophysical instruments facilitate detection of subsurface targets by measuring anomalous readings caused by the targets relative to a background level. These geophysical anomalies are the basis of UXO detection. If the background level of an instrument varies over time (drifts), then the capability to detect anomalous features in the data associated with buried targets is diminished. As such, all instruments require the calibration of the background instrument level.

Instrument drift will be measured by recording data over conveniently located areas known to be free of subsurface geophysical anomalies. These drift calibration areas will be defined by surveying the site with geophysical sensors to locate a parcel with no measurable anomalous geophysical features. Once established, each sensor will record data over the site

in north-south and east-west transects at least twice per day, once before any field data are collected and once after all data are completed. These data will be downloaded and reviewed by the Project Geophysicist on a daily basis to determine whether DC adjustments are required in any of the collected field data.

5.3.2 Diurnal Corrections

The earth's magnetic field can be affected by electrical storms, solar flares, and magnetic storms, as well as local sources of ferrous materials (e.g. fences, structures, vehicles, etc.) or electrical noise (cell phones, radios, etc,). Diurnal or daily changes in the earth's magnetic field also occur and must be compensated for. This is accomplished by logging total field magnetometer data at an established base station while field surveying is occurring. The diurnal base station will be a Geometrics G856 proton precession total field magnetometer, and will be established over a site determined to be clear of subsurface anomalies.

Data from the diurnal base station are downloaded daily and utilized during the data processing step to adjust the survey data for fluctuation in the earth's magnetic field.

5.3.3 Standardization Procedures

Just as the effects of sensor drift require quantification to allow for effective geophysical mapping, sensor standardization is also required to ensure collection of accurate and repeatable UXO target signature data. The objective of standardization procedures is to determine whether each deployed sensor is adequately operating within the sensor performance specification. To ensure that each data collection activity results in repeatable data, the following steps will be executed:

- Instrument serial numbers will be recorded in field logs.
- Personnel will be checked for metallic objects prior to survey commencement.
- Wiring will be secured to the transport structure to minimize noise directly from the instrument.
- Azimuth measurements will be made to determine any dependence of the measured signal on azimuth and corrections will be applied to measurements obtained along different azimuths, as necessary.
- Navigation instrumentation will be calibrated over a known monument and recalibrated over a known point daily.
- Instrument calibrations will be performed, recorded, and logged each morning and evening over a known source to insure that instrument functionality is maintained within the required specifications of repeatability.
- Individual measurements will be compared to the locally obtained statistical baseline information to determine the normal operating range and deviations that constitute failure.
- System timing delays will be determined from the calibration data and corrected to insure accurate positioning.

- Tick wheel operation and/or fiducial marks will be used as a primary or back-up method of positioning when GPS or acoustic methods cannot be applied or fail in the field.
- Instrument transport structures will be maintained level to ensure consistent positioning and data.
- During grid operations, the first and last lines will be repeated in opposite directions to ensure instrument and data quality.
- GPS features will be recorded for each individual grid and meander path to serve as a backup record independent of the field log and field maps.
- Field geophysicists and instrument operators will continuously check instrument readouts and audio alerts to ensure proper operation.

Standardization procedures are modified on a site-specific basis to maximize efficiency and to adjust to logistical and schedule requirements.

5.3.4 Abbreviated Standardization Checks

Standardization for geophysical mapping is ensured through adherence to standard procedures and full documentation. The following are logs used to maximize sanitation, repeatability, and control of mapping activities:

- Crew Deployment Log: This log defines the location of each geophysical survey crew on a daily basis. The log tracks crew members, equipment, and the expected area to be surveyed. Attached to this daily log are maps of the areas to be surveyed containing the coordinates of benchmarks in the areas as well as the coordinates of each quadrant corner.
- Field Log: This log is filled out by each crew chief and details all activities of the survey. This is a daily log and contains observations about crew performance, sensor performance, site conditions, soil conditions, and weather changes.
- Instrument Calibration Log: This log documents the daily calibration of each field instrument. Daily calibration procedures are executed for each geophysical and navigational instrument. The sensor system is brought to a calibration area before each survey day starts and the background magnetic field and the magnetic field signal from a reference target are measured and recorded.
- Data Control Log: Kept in the office trailer, this log tracks all data flowing in from the field and out to the office. Data include all geophysical field data, calibration data (via Calibration Logs), all field notes from field logs, and all GPS quadrant coordinate data. This log tracks the GIS system electronically, with hard copy prints made daily.
- Data Processing Log: All magnetometer data from the field are run through a standard data processing procedure. This procedure is the same for all data and is tracked with the data processing log. This log documents all coordinate transformations, visual data quality checks, statistical data quality checks, survey coverage statistics, interpolation parameters, etc.

5.3.5 Instrument Response to a Known Standard

Geophysical instruments used for mapping activities, anomaly reacquisition, hole clearance, and QC will be field-tested daily to ensure that they are operating properly. The Project Geophysicist, in consultation with the LANTDIV, will establish standard calibration lines over known inert OE items buried in a test grid. If the standard indication cannot be attained, the instrument will be re-calibrated, repaired, or replaced.

- The function of each geophysical instrument will be checked according to the manufacturer's specifications upon daily checkout by the survey teams.
- Each digital geophysical instrument will measure and record two standard calibration test lines over known inert OE items each morning prior to use. Peak anomaly readings over the OE items within 10 percent of the known values will be considered to indicate that the instrument is functioning correctly.
- Each digital geophysical instrument will measure and record two standard calibration test lines over known inert OE items at the end of each day and at any other time at the discretion of the instrument operator or the Project Geophysicist, to assess instrument functionality and drift.
- Analog geophysical devices will be tested at the beginning and ending of every work day over the standard calibrations. If an audible response is not achieved over each known buried OE item, the instrument will be re-calibrated, repaired, or replaced as necessary.

5.4 Data Processing: Correction and Analysis

UXO geophysical data analysis begins after execution of standard data processing steps in which field data are verified, cataloged, reviewed, and converted into interpolated grid files in state plane coordinates.

Geosoft's Oasis montaj™ UX-Detect software and onsite Surfer (a software packaged by Golden Software) or another suitable software approved by NOSSA, will be used to analyze and interpret the collected geophysical survey data. This software facilitates interpretation of digital magnetic and electromagnetic data sets. Output from this analysis will be used to identify any anomalous areas that require further investigation. The final geophysical data set will then be provided to LANTDIV for independent interpretation/evaluation.

Analysis of geophysical data includes the following procedures, all of which are documented in the data processing log:

- Initial data review
- Specialized filtering
- Target detection
- Target analysis
- Analysis review

5.4.1 Initial Data Review

One-dimensional data (from transects and meandering paths) and two-dimensional data (from grids and contiguous surveys) will be reviewed for accuracy, completeness, and data fidelity. Grid data will be loaded in the project GIS for comparison with cultural features that exist within the GIS. Additionally, the initial review in the GIS allows the operator to examine the data with respect to the visual features observed onsite and captured via GPS. The operator will examine the quality of the data and define additional filtering or re-processing of the data that may be necessary. The operator will validate that the data are complete and that the data fall within the prescribed grids bounds.

Additionally, one-dimensional line data will be re-reviewed in Geosoft's Oasis montaj™ UX-Detect software, which has a profile display mode. All observations related to data review will be fully documented in the data processing log.

5.4.2 Specialized Filtering

Geophysical data sets may require additional processing to extract the maximum amount of information about subsurface targets. This filtering process is an important component of the analysis because it allows low amplitude signatures to be accentuated and low-relief targets to be detected. Filters are applied to minimize noise and reduce effects of geologic trends and adverse soil conditions. The resulting filtered grids will be analyzed in the Geosoft Oasis montaj™ UX-Detect software system by a trained operator to identify more subtle targets possibly missed in the standard approach.

5.4.3 Target Detection

Targets are detected in a two-step process:

1) Initial automated detection

2) Operator-aided detection by a qualified geophysicist

The first step is automated target detection based on threshold analyses. Geosoft's Oasis montaj™ UX-Detect is used for simple threshold detection and is augmented by in-house methods utilizing a region-growing algorithm for more sophisticated auto detection and feature extraction. Parameters controlling the selection of targets include proximity of adjacent targets, signal power density, collocation of targets on other channels of data, areas size, and distribution of anomaly amplitudes.

The second step is manual detection of targets based on systematic visual search of raw and filtered data, on single or multiple channels. This is accomplished within the Geosoft Oasis montaj™ UX-Detect software system. At this stage, automatic target detections are modified, deleted and/or added to by the operator. The automated and operator target detection steps result in a target list and a set of target parameters, including X, Y, area, semi-major length, semi-minor axis length, proximity to other targets, and signal strength statistics.

5.4.4 Target Analysis

Detected anomalies will be analyzed to estimate target parameters including Easting, Northing, depth, and mass. Two different analysis methods, based on analytical models and empirical models, will be used to characterize the targets and are employed depending on the type of data collected. GeoSoft Oasis montaj™ UX-Detect software is used with total field magnetometer for mass and depth characterization based on a two-dimensional Euler deconvolution algorithm that calculates the apparent depths and weights of selected magnetic targets. The apparent depth to the magnetic source is derived from Euler's homogeneity equation, which relates the magnetic field and its gradient components to the location of the source of an anomaly, with the degree of homogeneity expressed as a "structural index." Additionally, a magnetic dipole model is employed to estimate target depth and magnetic moment through an iterative least-square model-matching algorithm. Magnetic moment is related to ferrous mass through an empirical relationship. For electromagnetic data, empirical relationships based on the signal strength and spatial extent on both channels of the EM-61 sensor are used to estimate target mass and depth.

In addition to these methods of target analysis, the operator uses a signature database to review the algorithm-based results. In this process, each target is reviewed relative to target signatures of known items buried at known depths and orientations. Additionally, as excavation groundtruth data is acquired during UXO removal, the information is fed back to the Project Geophysicist and incorporated within the project site UXO target signature database. Through this process, knowledge base project site signatures increase, and the effectiveness of data analysis improves.

5.4.5 Analysis Review

Review of data analysis is comprised of five steps. First, a review is performed of all entries in the data processing log that track both the chain of custody of the data and all numerical procedures that have been applied to the data. Second, 10 percent of all data are reprocessed and re-analyzed to ensure replication of the results. Third, all target detection data are reviewed by a second qualified geophysicist. Fourth, all target detection and geophysical data are reviewed within the project GIS to ensure that no cultural features are masking potential new targets, and that no detected targets are actually cultural features. Fifth, the results of all excavation activities are fed back to the Project Geophysicist for confirmation of excavation. Under this process, all groundtruth data is checked to make sure that the item removed during excavation is of the size, type, and orientation consistent with the recorded data.

5.5 Quantitative Interpretation and Dig Sheet Development

The target analysis process culminates in the creation of dig sheets, which contain target location, depth, and weight estimates. The dig sheets will also contain listings of the peak raw amplitudes recorded on sensors and the distance from the peak amplitude to the 50 percent amplitude level. These amplitude values are used to verify that the correct target is excavated.

For each grid, the geophysical subcontractor will assess each of the following factors prior to generating an anomaly list:

- The local background conditions of the magnetic, gradiometric, or electromagnetic response
- Data completeness and accuracy
- Data quality based on the survey and grid QA data
- The grid boundary conditions, utilities and/or other cultural features present, and unsurveyable areas (beneath roads, trees, buildings, etc.)
- A delineation of the extent and boundaries of metal-rich landfill areas, if any (Anomaly lists will not be generated for metal-rich landfill areas)

The criteria for selecting and locating anomalies for the anomaly list include the following items:

- The maximum amplitude of the response
- The maximum amplitude of the response with respect to local background conditions
- The lateral extent (plan size) of the area of response
- The three-dimensional shape of the response
- The location of the response with respect to the edge of the grid, unsurveyable areas, land features, cultural features, or utilities within or adjacent to the grid
- The shape and amplitude of the response with respect to the response of known targets buried in the geophysical prove-out test plot
- The shape and amplitude of the response with respect to relevant anomalies encountered in previous OE removal grids
- The apparent depth of the anomaly
- Potential distortions in the response due to interference from nearby cultural features
- Supplemental analysis of the top coil or differential data as necessary
- Any instrument or grid survey QC that could affect the analysis

The Project Geophysicist will analyze the geophysical data for each OE removal grid, identify anomalies that may represent buried UXO, and prepare anomaly lists containing the following information:

- Project site
- Geophysical contractor
- Responsible geophysicist
- Grid identification
- Grid corner locations in state plane coordinates
- Grid background response levels

- Unique anomaly identification numbers
- Predicted anomaly easting and northing in both local grid (relative) coordinates and in state plane coordinates
- Instrument peak value at each anomaly location

The anomaly lists will be prioritized; anomalies deemed more likely to be UXO will be ranked higher than anomalies less likely to be UXO. A proposed, grid-specific "cut line" for preparation of the dig sheet will also be provided. The dig sheet will be of a subset of the anomaly list. Anomalies below the "cut line" will generally not be excavated unless warranted by field conditions. Each anomaly list submitted to LANTDIV will be accompanied by a proposed "cut line," separating the recommended dig locations from the anomalies unlikely to represent UXO. The "cut line" for each grid will be established based on the site conditions for each OE removal grid. Based on its QA review, LANTDIV may accept or adjust the "cut lines," or add additional dig locations prior to accepting a final dig list for each OE removal grid.

5.6 Anomaly Reacquisition

Before intrusive activities can be performed, the geophysical anomalies identified on the digital geophysical surveys must be reacquired. Anomaly reacquisition is a two-step process. The first step is to locate the ground position of the anomaly coordinates as specified on the dig sheet. This will be performed using differential GPS, conventional survey methods, or measuring tapes, based on local site conditions. A white non-metallic pin flag, labeled with the unique anomaly number, is placed in the ground at the indicated grid coordinates. The second step is to use the same instrument used to detect the target (total field magnetometer, vector gradiometer, or electromagnetic sensor) to identify the peak location of the anomaly, the precise location on the ground where the excavation should occur. The sensor will be moved back and forth over the general area of the anomaly coordinates until the peak value of the anomaly is located. If more than one peak is located, the peak with the highest amplitude will be selected. If no unique peak value is present (i.e., the same peak value is measured over an area) the center of the maximal area will be selected. If no peak value is located at the indicated location, the white anomaly location flag will be left in place and the Project Geophysicist will be consulted.

The peak value measured over the anomaly will then be recorded and the dig location will be marked with a colored flag labeled with the anomaly number. The specified relocation process serves three purposes:

1) It focuses the excavation over the actual anomaly peak, instead of an interpolated location between the survey measurement points;

2) It reduces measurement errors; and

3) It provides a quality control ground check for the dig locations.

All discrepancies between the dig sheet location and the actual reacquired location, and any anomalies that could not be reacquired, will be recorded. The reacquisition location will be

measured and logged. The reacquisition coordinates will be used as the official dig location for location quality control assessment.

5.7 Feedback Process

The feedback of groundtruth excavation data is one of the most important ways to ensure efficient and effective UXO geophysical mapping. Excavation data collected during each intrusive activity will be captured to document the item location, weight, shape, orientation, and depth. This data will be electronically entered into a groundtruth database and incorporated within the project GIS.

The feedback process will also populate the database developed for each target signature developed during the data processing and analysis steps. The Project Geophysicist will review the target signatures in conjunction with the integrated groundtruth data to evaluate local geologic/geophysical effects on the target signatures. This information will be described in weekly reports and be communicated to the staff processing and reviewing geophysical data.

Excavation results for each OE removal grid will be posted on the project-provided internet web site within approximately three working days of grid completion. The Project Geophysicist, or a designate, will review the excavation results with respect to the anomaly selection criteria, "cut-line" level selection, QC dig results, actual UXO encountered, and any performance criteria failures, and will provide a weekly progress report with recommendations to LANTDIV.

5.8 Quality Control

Geophysical mapping QC will be defined on a site-specific basis and will be dictated by the sensors, navigation methods, survey modes utilized to achieve the site-specific objectives. The following QC steps, however, will be incorporated into all site-specific plans:

- Daily pre- and post-operation instrument calibrations to ensure readings within manufacturer's specifications
- Digital capture of data over standard calibration response objects with 10 percent variation threshold
- Navigation calibration via twice-daily acquisition of survey benchmark locations
- Target reacquisition accuracy testing via repetitive acquisition of selected anomalies
- Post-operation equipment checks to ensure that equipment is serviceable, with damaged or malfunctioning gear identified. Equipment maintenance program with preventive and corrective response measures.
- Independent review of raw and processed data via OE QC Analysts. All dig sheets reviewed by two qualified geophysicists prior to intrusive activity.
- Audits of field procedures with defined pass/fail criteria and defined corrective measures

- Defined records management and review procedures
- Selection of additional targets not initially selected for dig sheets. Selecting additional targets numbering 10 percent of original list verifies false alarm reduction techniques.
- Random sampling of completed grids. QC specialist performs hand-held mag or EM sweep identifying metal debris. Targets numbering 10 percent of detected targets selected for excavation to validate discrimination methods. Results reported to Project Manager and corrective actions identified.
- Confirmatory excavations. Upon LANTDIV concurrence, small sub-grids (e.g., 100 sq ft) fully excavated to prescribed depths. Spoils checked to ensure 100 percent OE removal. Results reported to Project Manager and corrective actions identified as needed.
- Comparative review of intrusive results. Excavation results reviewed by Project Geophysicist ensuring excavated anomalies correspond to the selected targets. The size, depth, and orientation of each target compared with digital data identifying possible mis-matches. All suspect intrusive results will be reinvestigated.
- Comprehensive digital documentation of site activities with in-place feedback procedures to capture lessons learned. Daily "lessons-learned" component of morning safety tailgate briefings.

After each excavation is completed the field crew will collect a target signature over the excavation area in an "X" pattern. The crossing profiles will be at least 20 ft long and will be collected in the north-south/east-west directions. This post-excavation data will be supplied to the Project Geophysicist for review. The purpose of this data collection is to validate and verify that after the excavation is completed, no additional anomaly associated with an additional target exists at the excavation location.

The raw and processed geophysical survey data, replicate and other QC data, field notes, data processing parameters, maps, anomaly lists, and proposed "cut lines" for each OE removal grid will be provided by the geophysical subcontractor to the Project Geophysicist, or his designate, for QC review. If acceptable to the project team, the data will be considered to be in draft form and will be provided to LANTDIV for review at least 2 weeks prior to planned intrusive activities in that particular grid.

A QA review of the data and proposed dig lists will be performed by LANTDIV. Selected geophysical data and target lists may also be reviewed by other designated QA parties. The Project Geophysicist or a designate will address comments received from any review, and responses will be submitted to the LANTDIV. Upon acceptance of comment responses by the LANTDIV, the geophysical data, maps, and dig list will be made available for use by the UXO teams.

QC audits, to ensure that the overall QC procedures and objectives of the project are met, will be performed at the discretion of the CH2M HILL Project Manager.

5.9 Corrective Measures

Specific corrective measures dependent on the type of geophysical equipment used during an operation and will be developed on a site-specific basis. The following basic corrective measures, however, are employed by CH2M HILL for digital geophysical mapping:

- Replacement of sensors if they fail to meet calibration requirements
- Replacement of navigation equipment if daily checks of location accuracy are not met
- Re-survey of grids when data quality specification are not met
- Re-processing of all geophysical data collected during a survey day if 10 percent re-processing procedures result in detection of additional valid targets
- Re-excavation of targets if Project Geophysicist determines that the excavated targets are not associated with the initial target anomaly

5.10 Records Management

CH2M HILL will establish a geophysical records management plan upon issuance of site-specific task orders. The following items will be contained in each plan:

- **Field survey records management:** All data files and field logs generated during the filed operation will be managed by the Project Geophysicist. Paper files will be organized in the office trailer and filed by individual day. Photocopies of all paper documents will be made and filed at an offsite location. Electronic files will be organized on an office PC dedicated to geophysical investigation management. Electronic files include, but are not limited to: magnetometer files, gradiometer files, EM61 sensor files, diurnal base station files, rover GPS files, base station GPS files, sensor calibration files, and drift correction files. File directory structures will be organized by day-of-year, with subdirectories for specific field activities (GPS data, survey data, etc.). All field data will be backed up onto CD ROM or tape on a daily basis, and will also be transferred to an offsite CH2M HILL location.
- **GIS records management:** All generated and developed GIS files will be managed by the GIS Specialist and stored on an onsite PC dedicated for GIS management and analysis. The data will be stored within the standard GIS sub-directory structure with "README" files in each directory containing a description of the contained files. All GIS data will be backed up onto CD ROM or tape on a daily basis, and will also be transferred to an offsite CH2M HILL location.
- **Data processing and analysis record management:** All data files and data processing logs generated during the processing and analysis of geophysical field data will be managed by the Project Geophysicist. Paper files will be organized in the office trailer and will be filed by individual day. Photocopies of all paper documents will be made and filed at an offsite location. Electronic files will be organized on an office PC dedicated to geophysical investigation management. File directory structures will be organized by day-of-year, with subdirectories for specific field activities (GPS data,

survey data, etc.). All field data will be backed up onto CD ROM or tape on a daily basis, and will also be transferred to an offsite CH2M HILL location.

All data (field data, GIS data, geophysical processing, and analysis data) will be backed up as a complete system on a weekly basis onto CD. Two copies of the CD will be created, with one copy stored in the office trailer and one copy sent to an offsite CH2M HILL location.

5.11 Interim Reporting

Access to interim data will be provided via a project internet web site or other appropriate method. All digital data will be provided in formats compatible with the LANTDIV's computer systems. Interim data will include:

- CADD base and topographic maps for all OE removal grids, with grid control points, in Intergraph .DGN or AutoCAD Release 14 .DXF format
- Draft and final geophysical data, as specified in Section 5.7, for all OE removal grids
- Grid data and QC reports for all OE removal grids in Word97 format
- Draft and final anomaly lists for all OE removal grids in Excel97 format
- Dig lists and relocation coordinates for all OE removal grids in Excel97 format
- Anomaly excavation reports for all OE removal grids in Excel97 format
- QA dig lists and excavation reports for all OE removal grids in Excel97 format

5.12 Final Reports and Maps

All sensor data will be pre-processed for sensor offsets and diurnal magnetic variations, and correlated with navigation data. The approved geophysical mapping technology will digitally capture the instrument readings into a file coincident with the state grid coordinates. This field data will be checked, corrected, and processed into ASCII files in the ADF file format. Corrections such as for navigation and instrument bias will be applied, but there will be no filtering or normalization of the data. All corrections will be documented.

The data will be presented in delineated fields as x, y, and z, where x and y are state plane coordinates in east and north, and z is the instrument reading. Where there are multiple instrument values, such as with the EM instruments, the channels will be provided in separate files. Each of the three data fields will be separated by a space (not a comma). TDEM data will consist of two separate files of three columns in the same format, with the z component for the top and bottom coils (for the EM-61) or for the early and late time gates (for the EM-61HH) in separate files. No header or other information will be included in the file. No individual file may be more than 4 megabytes in size and no more than 60,000 lines long. Each grid of data will be logically and sequentially named so that the file name can be correlated easily with the grid name used by other project personnel.

A digital planimetric map of each OE removal grid, in Intergraph .DGN format or AutoCAD Release 14 .DXF format, will be made available to LANTDIV for inspection prior

to the collection of any new grid geophysical data. These maps will reflect the current site conditions after site preparation work (removal of fencing, dumpsters, play-sets, etc.) has been completed. These maps will be in state plane coordinates, and will coincide with the location of the geophysical survey data.

For each OE removal grid, the complete digital geophysical data set for each OE removal grid will be made available for LANTDIV inspection within approximately seven days of the completion of survey activities for that grid. All data is considered to be in draft form until LANTDIV comments are received and addressed.

The geophysical data for each OE removal grid will be accompanied by a Microsoft Word file documenting the field activities associated with the data collection, the data processing performed, and the results of the CH2M HILL QC review.

SECTION 6

CH2M HILL Site Safety and Health Plan

This site-specific Safety and Health Plan supplements the Safety and Health Plan provided in Section 6 of the *Draft Final OE Master Work Plan*, and is intended for convenient reference by field personnel during implementation of OE activities at SWMU 4. The Navy Occupational Safety and Health Manual, OPNAVINST 5100.23E, will be referenced as necessary during implementation of field activities.

This Site Safety and Health Plan will be kept onsite during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the SOPs in the CH2M HILL Health and Safety Program, Program and Training Manual, as appropriate. In addition, this plan adopts procedures in the project Work Plan. The Site Safety Coordinator (SSC) is to be familiar with these SOPs and the contents of this plan. CH2M HILL's personnel and subcontractors must sign Attachment 6-1. The main objective of this project is to conduct a surface OE/UXO and scrap metal survey and anomaly reacquisition. CH2M HILL's SOP HSE-91 for OE is included in Attachment 6-2 of this plan.

6.1 Project Information and Description

Project No: 163995.PP.WP

Client: U.S. Navy

Project/Site Name: OE Survey and Anomaly Reacquisition for SWMU 4 at the Former NASD

Site Address: Vieques Island, Puerto Rico

CH2M HILL Project Manager: Martin J. Clasen, P.G.

CH2M HILL Office: Tampa, Florida

Date Health and Safety Plan Prepared: October 8, 2001

Date(s) of Site Work: October 2001 – December 2003

Site Access: All investigation sites are located at the Former NASD, in the western portion of Vieques Island, Puerto Rico. All Sites are accessed through the secure gate of the Former NASD.

Site Size: 8,000 Acres

6.1.1 Site Topography

Land surface elevations in the SWMU 4 area range from sea level to approximately 150 ft above mean sea level. The southern portion of the site borders the flanks of Mt. Pirata and

has the highest elevation (150 ft). The northern part of the site extends into a salt water lagoon near Punta Boca Quebrada and has the lowest elevations (mean sea level). The main OB/OD 40-acre area is relatively flat, except where a quebrada (drainage area that is dry except during storm events) cuts through the southern end of the site. The 40-acre area ranges in elevation from sea level to approximately 50 ft above sea level.

The majority of SWMU 4 has a dense shrub canopy of thorny shrubs and a scattered herbaceous stratum. The total vegetative cover was approximately 75 to 95 percent. Dominant shrubs identified on the site included *Acacia farnenciana, Prosopis glandulosa, Pithlcellobium dulce,* and *Zanthoxylum brevipes*. Another co-dominant shrub was *Leucaena leucocephala.* The herbaceous stratum was dominated by *Bothriochloa ischaemum, Commelina erecta, C. diffusa,* and *Lasiacis divaricata.* No endangered or threatened plant species were observed during the field survey.

6.1.2 Prevailing Weather

The climate of Vieques is characterized as warm and humid (tropical-marine), with frequent showers occurring throughout the year. The temperature on Vieques is affected by the easterly trade winds blowing across the island year-round. This wind moderates the temperature throughout the year, causing an annual mean temperature of 79°F to 80°F, and a mean daily temperature range of 15°F to 25°F. The average annual rainfall on the island is approximately 36 inches, with extremes of 25 inches in the east and 45 to 50 inches in the west.

6.1.3 Site Description and History

Vieques is the largest offshore island of Puerto Rico, with a surface area of approximately 51 square miles. It is located approximately 7 miles east-southeast of the eastern end of the main island of Puerto Rico, where NSRR is located. The Former NASD occupies the western end of the island of Vieques, encompassing approximately 7,878 acres. The majority of the site is undeveloped and heavily vegetated with trees, low-lying brush, and tall grasses. The southwestern portion of the site is the least developed, with the exception of the communications facilities on top of Mount Pirata (within the Former NASD but not technically a part of the site). The central eastern portion of the site was utilized for munitions magazines, which are scattered throughout the area. The northeastern portion of the site is the most developed, containing facilities for the main support compound. The southeastern portion of the site contains the Relocatable Over the Horizon Radar (ROTHR) station and associated facilities.

The Former NASD was utilized by the U.S. Navy Atlantic Fleet for storage of munitions. The activities at the Former NASD were directed under the consolidated command of Commander Fleet Air Caribbean, Naval Forces Caribbean, and Antilles Defense Command, whose headquarters are at NSRR. The mission of the Former NASD was to receive, store, and issue all ordnance authorized by NSRR for support of Atlantic Fleet activities. Munitions were stored in numerous bunkers located throughout the Former NASD. Other than the bunkers, the only other significant developments at the Former NASD consist of the main support compound located in the northeast portion of the facility, the Mount Pirata telecommunication sites located in the southwest portion of the facility, and the ROTHR site located in the southeastern portion of the facility.

Other activities that may potentially have been conducted at the Former NASD include amphibious assault training with blank ammunition and pyrotechnics by the U.S. Marines at the Former NASD. While the exact location and extent of the Western Training Area (WTA) has not been determined, it is possible that the beach located on the western end of Vieques may have been part of the WTA. This area of beach is known as Green Beach.

Munitions are not currently stored at the Former NASD and no Navy activities are being conducted at the facility, other than operations at the Mount Pirata telecommunication sites and the ROTHR facility. The main support compound is not in operation. Access control for the Former NASD is provided by contracted security operations.

In accordance with CERCLA and DoD requirements, an EBS of the Former NASD was conducted to assess the possible presence of sites potentially contaminated with hazardous materials resulting from past activities. Through the EBS, the Navy identified 17 areas of potential contamination. Of these 17 areas, three sites were identified to potentially contain OE.

This site-specific safety and health plan has been developed for SWMU 4, the inactive waste explosive OB/OD.

As part of the Navy's IR Program, SWMU 4 is being investigated in accordance with the CERCLA process to assess the potential presence of hazardous constituents at the sites. During the IR field investigations, UXO technicians were contracted to perform UXO avoidance surveys.

SWMU 4 was utilized for thermal destruction of waste munitions, fuels, or propellants. The material to be burned was placed in the OB area and a squib or other detonator was placed in the waste material. The open burn was then initiated from a safe distance using electrical detonation. In addition, material from the rework of munitions (loose powder and primers) and flares and cartridge-activated devices may also have been disposed at the unit. The inactive OB/OD area has reportedly been swept for live munitions by an EOD team from NAF. UXO technicians performing the avoidance surveys discovered various small UXO and OE scrap near the surface at SWMU 4.

6.2 Tasks to be Performed Under this Plan

6.2.1 Description of Tasks

Refer to project documents (i.e., Work Plan) for detailed task information. A risk analysis (Section 6.3) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin.

6.2.1.1 Hazwoper-Regulated Tasks

- Site Layout
- Surface geophysical surveys
  - Magnetic
  - Electromagnetic
- Vegetation removal
- Anomaly reacquisition

6.2.1.2 Non-Hazwoper-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state Hazwoper regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-Hazwoper-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

6.3 Activity Hazard Analysis for Unexploded Ordnance Operations

Table 6-1 shows hazards analysis, and Table 6-2 shows inspection requirements.

TABLE 6-1
Hazards Analysis

Principal Steps	Potential Hazards	Recommended Controls
Transportation of explosive materials [1]	Accidental detonation of explosives	Explosives will be transported in accordance with the 49, CFR, Parts 100-199.
		Explosives will be transported in closed vehicles whenever possible.
		When using an open vehicle, explosives will be covered with a flame resistant tarpaulin.
		Motor vehicles will be shut off when loading/unloading explosives.
		Beds of vehicles will have either a nonconductive bed liner, dunnage, or sand bags to protect the explosives from contact with the metal bed and fittings.
		Initiating explosives, such as blasting caps, will remain separated at all times.
		Each vehicle used for the transport of OE will be outfitted with a fire extinguisher and first aid kit.
		Do not fuel trucks when loaded with OE.
	Unqualified Drivers	Drivers operating outside the boundaries of any federal installation will be licensed in accordance with federal, state, and local regulations.
Transportation of explosive materials	Vehicle operations	Drivers will observe all posted speed limits while operating a motor vehicle on a public roadway.
		Vehicles transporting explosives offroad will not exceed 15 miles per hour (mph).
		Chock wheels when loading or unloading OE-related materials.

TABLE 6-1 (CONTINUED)
Hazards Analysis

Principal Steps	Potential Hazards	Recommended Controls
Storage of explosive materials [1]	Accidental detonation of explosives	Materials will be stored in accordance with federal, state and local regulations. Refer to the SOP for the Storage of Explosive Materials.
Surveying and establishing boundaries and grids	Accidental detonation of explosives	Personnel involved will attend a site-specific OE/UXO recognition class prior to the commencement of any site activities. UXO personnel will escort non-UXO personnel at all times. Mark and avoid UXO. Only UXO personnel will handle OE waste. Check location with magnetometer prior to driving stakes.
	Wildlife, slips, trips, falls, insects, poisonous plants, use of hand tools	Refer to the Activity Hazard Analysis for section of this SSHP.
Clearing and grubbing	Accidental detonation of explosives	Personnel involved will attend a site-specific OE/UXO recognition class prior to the commencement of any site activities. Be alert and mark all OE located. Only clear and grub to within 4 inches of the ground surface. UXO trained personnel will escort non-UXO personnel at all times. Surface sweeps will be conducted with magnetometers or other suitable geophysical instrumentation to identify potential OE.
Transportation of OE waste [1]	Accidental detonation of explosives	No personnel allowed in OE cargo department of vehicle.
	Accidental detonation of explosives	No OE allowed in passenger compartment of vehicle. Block, brace, secure OE. No smoking in vehicles used for transport of OE/UXO waste.
	Vehicle operations	Placard vehicle in accordance with U.S. Department of Transportation (DOT) regulations. Vehicles transporting explosives offroad will not exceed 15 mph. Drivers will observe all posted speed limits while operating a motor vehicle on a public roadway.

TABLE 6-1 (CONTINUED)
Hazards Analysis

Principal Steps	Potential Hazards	Recommended Controls
UXO disposal operations [1]	Accidental detonation of explosives	Observe procedures outlined in EODB 60A-1-1-31.
OE-related scrap demilitarization	Accidental detonation of explosives	Only UXO technicians will perform explosive demilitarization of OE-related scrap.
	Shredder Operations	Stay clear of moving mechanical parts.
		Ensure that only inspected scrap is fed into shredder.
Inspection/certification of ORS	Accidental detonation of explosives	Only UXO technicians will inspect OE-related scrap.
		Personnel in the immediate vicinity of OE-related scrap inspections will be kept to the minimum necessary for safe operations but no less than two UXO technicians.
		Observe requirements of DoD 4160.21-M-1.
Anomaly reacquisition	Accidental detonation	Only UXO technicians will excavate or handle UXO.
		Personnel in the immediate vicinity of UXO operations will be kept to the minimum necessary for safe operations, but no less than two UXO technicians.
		Do not subject UXO to heat, shock, or friction.
		Only hand excavation permitted when within 1 ft of UXO.
		Magnetometers will be used frequently to pinpoint the location of UXO.
	Non-UXO personnel	Establish exclusion zone (EZ); post warning signs, maintain site control.
		Stop all UXO operations when non-UXO trained personnel are within the EZ.

[1]For the SWMU 4 and other Former NASD UXO investigations, only the UXO subcontractor or NSRR EOD personnel will transport OE/UXO material and explosives.

TABLE 6-2
Inspection Requirements

Equipment to be Used	Inspection Requirements	Training Requirements
Vehicles Fire extinguishers First aid kits Demolition materials Explosives Blocking, bracing, and cushioning materials Manual hand tools Mechanized equipment EMM Geophysical instrumentation Global Positioning System instrumentation PPE Communications equipment	Daily preventive maintenance and operational checks First aid kits Calibration of geophysical instrumentation	40-hour qualification per 29 CFR 1910.120 8-hour refresher UXO personnel EOD trained Tailgate safety meetings Site-specific orientation Lead awareness training Poison oak awareness training

6.4 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards. These practices and controls are to be implemented by the party in control of either the site or the particular hazard. CH2M HILL employees and subcontractors must remain aware of the hazards affecting them regardless of who is responsible for controlling the hazards. CH2M HILL employees and subcontractors who do not understand any of these provisions should contact the SSC or UXOSO for clarification. The main physical or safety hazards posed to CH2M HILL personnel during project activities are described below.

6.4.1 Ordnance Explosives (OE Standards of Practice, SOP HSE-91)

OE includes UXO, Chemical Warfare Material (CWM), OE-contaminated soils and groundwater, range maintenance, ordnance demilitarization (Demil), and demining. OE/UXO may be encountered during field activities. Sites potentially contaminated with OE/UXO will be screened by the UXO contractor with qualified UXO Technicians prior to and during field activities.

CH2M HILL employees who are potentially exposed to hazards associated with OE activities shall follow the requirements described in this section regardless of the company performing the OE operation. These requirements also pertain to OE subcontractor personnel when CH2M HILL is providing oversight. Personnel knowledgeable of OE/UXO safety precautions must observe these precautions at all times. They must also advise others in the vicinity of proper precautions for the protection of all personnel in an OE/UXO danger area.

- Only qualified UXO Technicians or EOD personnel will locate, identify, handle, remove, transport, store, or dispose of OE/UXO items.

- The preferred and safest method for disposal of OE/UXO is to destroy it in its original position by demolition (BIP) whenever circumstances permit. By this method, both the ordnance and the hazard it poses are eliminated in one operation.
- Munitions that have been determined to be "safe to move" by an authorized UXO Technician can be transported to an approved holding area or disposal site.
- One person acting alone should never conduct operations involving contact with OE/UXO.
- OE/UXO must not be moved or disturbed in any way unless it has been determined to be safe to do so by a qualified UXO technician. Operations in the vicinity of OE/UXO should only be conducted after a complete work plan, including emergency procedures, has been established.
- Electronic equipment capable of emitting electromagnetic radiation (such as radios or cellular phones) shall not be activated in the vicinity of known or suspected electrically initiated ordnance.
- Munitions having no color-coding, incomplete color-coding, or improper color-coding are not uncommon, so color coding should not be relied on as a positive identification of ordnance.
- Inhalation of, and skin contact with, smoke, fumes, and vapors of explosives and related hazardous materials shall be avoided.
- OE/UXO that has been exposed to fire or detonation must be considered extremely hazardous. Chemical and physical changes may have occurred to the contents, which render it more sensitive than when in its original state.
- When encountered, attempts should be made to positively identify OE/UXO items. The item shall be carefully examined for markings and other identifying features such as shape, size, and external fittings. The item should not be moved prior to inspection.
- Ordnance shall be approached from the side because munitions may contain an ejection hazard, shaped charge explosive jet hazard, rocket motor, or fuzing sensitive to movement.
- Unnecessary personnel must not remain in the vicinity of OE or UXO.
- Ordnance items must be considered armed and dangerous.
- Fired ammunition or ordnance should not be considered safe.
- Souvenirs shall not be collected.
- Ordnance items larger than .50 caliber are considered UXO and may contain high explosives.

6.4.2 Excavation

OE/UXO subcontractors are responsible for providing a competent person to oversee OE operations. A competent person may be a SUXOS, UXOSO, UXO QC Specialist, or a UXO

Technician III. Occupational Safety and Health Administration (OSHA) regulations describe a competent person as one who is capable of identifying existing and predictable hazards in the work surroundings and has the authorization to take prompt corrective measures to eliminate them.

The competent person must meet the following minimum qualification requirements:

- Be a graduate of either of one of the following: U.S. Army Bomb Disposal School, Aberdeen Proving Ground, MD; U.S. Naval EOD School, Indian Head, MD; U.S. Naval EOD School, Eglin Air Force Base, FL; EOD Assistants Course, Redstone Arsenal, AL; EOD Assistant Course at Eglin Air Force Base, FL; or a U.S. DoD-certified equivalent course.
- Have at least 10 years of combined active duty military EOD and contractor UXO experience.
- Have experience in OE clearance operations and supervising personnel.

The requirements of this section shall be followed by CH2M HILL employees who are potentially exposed to hazards associated with excavation activities, regardless of the company performing the excavation operation. The requirements below also pertain to excavation subcontractor personnel when CH2M HILL is providing oversight.

(Reference CH2M HILL SOP HSE-32, Excavations)

- Do not enter the excavations unless completely necessary, and only after the competent person has completed the daily inspection and has authorized entry.
- Follow all excavation entry requirements established by the competent person.
- Do not enter excavations where protective systems are damaged or unstable.
- Do not enter excavations where objects or structures above the work location may become unstable and fall into the excavation.
- Do not enter excavations that potentially contain a hazardous atmosphere until the air has been tested and found to be safe.
- Do not enter excavations with accumulated water unless precautions have been taken to prevent excavation cave-in.
- Use the Health and Safety Self-Assessment Checklist found in Attachment 6-5 of this Site-Specific Work Plan to evaluate excavations prior to entry.
- Conduct OE/UXO avoidance during excavation operations on known or suspect OE sites.
- Prior to excavation crews entering any of the sites, conduct a reconnaissance and OE avoidance activities to provide clear access routes to each site, according to the following procedures:
  - Identify and clearly mark the boundaries of a clear approach path for the sampling crews, vehicles, and equipment to enter the site. This path will be, at a minimum,

twice the width of the widest vehicle. No one will be allowed outside any marked boundary.

- If OE is encountered on the ground surface, clearly mark the area where it is found, report it to the proper authorities, and divert the approach path around it.
- Conduct an access survey using the appropriate geophysical instrument over the approach path for avoidance of OE that may be in the subsurface. If a magnetic anomaly is encountered, assume it is OE and divert the approach path around the anomaly. Only UXO personnel will operate the appropriate geophysical instrument and identify OE.

- After preparing the site, employ the following approaches to excavation:
  - Remember that hand excavation is the most reliable method for uncovering OE.
  - Consider earth-moving machinery (EMM) to excavate overburden from suspect OE. EMM will not be used to excavate within 12 inches of suspected OE.
  - Use a step-down or offset access method for hand or EMM excavation methods.

6.4.3 General Hazards

The general physical or safety hazards posed to CH2M HILL personnel during project activities are:

- General hazards and housekeeping
- Hazard communications
- Shipping and transportation of chemical products
- Manual lifting
- Fire prevention
- Electrical
- Ladders
- Thermal stress
- Compressed gas cylinders
- Utilities
- Working on water
- Working near water
- Slips trips and falls
- IDW drum sampling
- Confined space entry
- Working around material handling equipment
- Biological hazards and controls
- Other hazards

The health and safety control measures for these hazards are described below.

6.4.3.1 General Hazards and Housekeeping

- Site work must be performed during daylight hours whenever possible. Work conducted at night requires enough illumination intensity to read a newspaper without difficulty.

- Hearing protection must be worn in areas where shouting is necessary to hear someone within 3 ft.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel must be established and kept free from the accumulation of materials.
- Aisles, exits, ladders, stairways, scaffolding, and emergency equipment must be kept free from obstructions.
- Slip-resistant surfaces, ropes, and/or other devices must be provided.
- Stairs or ladders are generally required when there is a break in elevation of 19 inches or more.
- Specific areas shall be designated for the proper storage of materials.
- Tools, equipment, materials, and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers shall be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

6.4.3.2 Hazard Communication

The SSC or UXOSO is to perform the following:

- Complete an inventory of chemicals brought onsite by CH2M HILL using Attachment 6-3.
- Confirm that an inventory of chemicals brought onsite by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from LANTDIV, contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive onsite, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.
- Give employees required chemical-specific HAZCOM training using Attachment 6-3.

6.4.3.3 Shipping and Transportation of Chemical Products

Chemicals are not expected to be needed as part of the field efforts. If chemicals are determined to be necessary, these chemicals might be defined as hazardous materials by DOT. All staff who ship the materials or transport them by road must receive CH2M HILL

training in shipping dangerous goods. All hazardous materials that are shipped (e.g., via Federal Express) or are transported by road must be properly identified, labeled, packed, and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

6.4.3.4 Manual Lifting

These proper lifting techniques must be used when lifting any object:

- Plan storage and staging to minimize lifting or carrying distances.
- Split heavy loads into smaller loads.
- Use mechanical lifting aids whenever possible.
- Have someone assist with the lift, especially for heavy or awkward loads.
- Make sure the path of travel is clear prior to the lift.

6.4.3.5 Slips, Trips, and Falls

- Institute and maintain good housekeeping practices.
- Pick up tools and debris in the work area.
- Walk or climb only on equipment surfaces designed for personnel access.
- Be aware of poor footing and potential slipping and tripping hazards in the work area.

6.4.3.6 Fire Prevention

- Fire extinguishers must be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 ft. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 ft. Extinguishers must:
  - Be maintained in a fully charged and operable condition
  - Be visually inspected each month
  - Undergo a maintenance check each year
- The area in front of extinguishers must be kept clear.
- "Exit" signs must be posted over exiting doors, and "Fire Extinguisher" signs must be posted over extinguisher locations.
- Combustible materials stored outside should be at least 10 ft from any building.
- Solvent waste and oily rags must be kept in a fire-resistant, covered container until removed from the site.
- Flammable/combustible liquids must be kept in approved containers, and must be stored in an approved storage cabinet.

6.4.3.7 Electrical

- All temporary wiring, including extension cords, must have ground fault circuit interrupters (GFCIs) installed.
- Extension cords must be:

  - Equipped with third-wire grounding
  - Covered, elevated, or protected from damage when passing through work areas
  - Protected from pinching if routed through doorways

- Electrical power tools and equipment must be effectively grounded or double-insulated, UL-approved.
- Electrical power tools, equipment, and cords must to be inspected for damage before use. If damaged, they shall be tagged and removed from service.
- Electrically powered equipment must be operated and maintained according to manufacturer's instructions.
- All electrical equipment, tools, switches, and outlets must be protected from elements.
- Only qualified personnel are to work on energized electrical circuits and equipment.
- Only authorized personnel are permitted to enter high-voltage areas.
- Switches, fuses, and breakers must be properly labeled.
- All 120-volt, single-phase 15 and 20 ampere receptacle outlets on construction sites, which are not part of the permanent building wiring, must be equipped with GFCIs for personnel protection.
- All portable electric generator receptacles must be effectively grounded by bonding the receptacle grounding wire to the generator frame.

6.4.3.8 Ladders

- Ladders must be inspected by a competent person for visible defects prior to each day's use. Defective ladders must be tagged and removed from service.
- Portable ladders must extend at least 3 ft above landing surface.
- The ladder must be faced when climbing with belt buckle between side rails.
- Both hands must be used to climb; ropes should be used to raise and lower equipment and materials.
- Straight and extension ladders must be tied off to prevent displacement.
- Ladders that may be displaced by work activities or traffic must be secured or barricaded.
- Fixed ladders greater than 20 ft in height must be provided with fall-protection devices.
- Stepladders must be used in the fully opened and locked position.
- The top two steps of a stepladder should not be used to sit or stand.
- Straight and extension ladders must be positioned at such an angle that the ladder base to the wall is one-fourth of the working length of the ladder.

6.4.3.9 Heat Stress

Preventing and Treating Heat Stress

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50°F to 60°F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Take regular breaks in a cool, shaded area. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate by slowly increasing workloads (e.g., do not begin with extremely demanding activities).
- Use cooling devices, such as cooling vests, to aid natural body ventilation The devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Provide adequate shelter or shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Monitor buddy for signs of heat stress. Persons who experience signs of heat rash or heat cramps should consult the UXOSO or SSC to avoid progression of heat-related illness.
- Cool down immediately if heat syncope (sudden fainting), heat exhaustion (hot, pale, clammy/moist skin), or heat stroke (red, hot, dry skin; loss of consciousness) is experienced and consume cool water or sports drink. Persons who experience heat syncope or heat exhaustion should also seek medical attention as soon as possible. Persons who experience heat stroke must get immediate medical attention.

Monitoring Heat Stress

These procedures should be considered when the ambient air temperature exceeds 70°F, the relative humidity is high (greater than 50 percent), or when workers exhibit symptoms of heat stress.

The heart rate (HR) should be measured by the radial pulse for 30 seconds, as early as possible in the resting period. The HR at the beginning of the rest period should not exceed 100 beats/minute, or 20 beats/minute above resting pulse. If the HR is higher, the next work period should be shortened by 33 percent, while the length of the rest period stays the same. If the pulse rate still exceeds 100 beats/minute at the beginning of the next rest period, the work cycle should be further shortened by 33 percent. The procedure is continued until the rate is maintained below 100 beats/minute, or 20 beats/minute above resting pulse.

6.4.3.10 Procedures for Locating Buried Utilities

Local Utility Mark-Out Service
Name: Caleb Romero, NSSR, Puerto Rico
Phone: (787) 865-4429, Ext. 4068/4268

- Where available, obtain utility diagrams for the facility.
- Review locations of sanitary and storm sewers, electrical conduits, water supply lines, natural gas lines, and fuel tanks and lines.
- Review proposed locations of intrusive work with facility personnel knowledgeable of locations of utilities. Check locations against information from utility mark-out service.
- Where necessary (e.g., uncertainty about utility locations), perform excavation or drilling of the upper depth interval manually.
- Monitor for signs of utilities during advancement of intrusive work (e.g., sudden change in advancement of auger or split spoon).
- When LANTDIV or another onsite party is responsible for determining the presence and locations of buried utilities, the UXOSO should confirm that arrangement.

6.4.3.11 Working Near Water

When working near water, and there is a risk of drowning, the following precautions should be taken:

- U.S. Coast Guard-approved personal flotation devices (PFDs), or life jackets, provided for each employee shall be worn.
- PFDs shall be inspected before and after each use. Defective equipment will not be used.
- Sampling and other equipment shall be used according to the manufacturer's instructions.
- A minimum of one life-saving skiff shall be provided for emergency rescue.
- A minimum of one ring buoy with 90 ft of 3/8-inch solid-braid polypropylene (or equal) rope shall be provided for emergency rescue.

6.4.3.12 Working on Water

- Safe means of boarding or leaving a boat or a platform must be provided to prevent slipping and falling.
- The boat/barge must be equipped with an adequate railing.
- Employees should be instructed on safe use.
- Work requiring the use of a boat must not take place at night or during inclement weather.
- The boat/barge must be operated according to U.S. Coast Guard regulations (speed, lightning, right-of-way, etc.).
- The engine must be shut off before refueling; do not smoke while refueling.

6.4.3.13 IDW Drum Sampling

Personnel are permitted to handle or sample drums containing only investigation derived waste (IDW); handling or sampling other drums requires a plan revision or amendment approved by the CH2M HILL HSM. The following control measures will be taken when sampling drums containing IDW:

- Minimize transportation of drums.
- Sample only labeled drums or drums known to contain IDW.
- Use caution when sampling bulging or swollen drums. Relieve pressure slowly.
- If drums contain, or potentially contain, flammable materials, use non-sparking tools to open.
- Do not use picks, chisels, and firearms to open drums.
- Reseal bung holes or plugs whenever possible.
- Avoid mixing incompatible drum contents.
- Sample drums without leaning over the drum opening.
- Transfer the content of drums using a method that minimizes contact with material.
- PPE and air monitoring requirements specified in Sections 6.6 and 6.7 must address IDW drum sampling.
- Spill containment procedures specified in Section 6.9 must be appropriate for the material to be handled.

6.4.3.14 Confined Space Entry

No confined space entry will be permitted. Confined space entry requires additional health and safety procedures, training, and a permit. If conditions change such that confined-space entry is necessary, the HSM must be contacted to develop the required entry permit.

When planned activities will not include confined-space entry, permit-required confined spaces accessible to CH2M HILL personnel must be identified before the task begins. The SSC is to confirm that permit spaces are properly posted or that employees are informed of their locations and hazards.

6.4.3.15 Working Around Material Handling Equipment

- Never approach operating equipment from the rear. Always make positive contact with the operator, and confirm that the operator has stopped the motion of the equipment.
- Never approach the side of operating equipment; remain outside of the swing and turning radius.
- Maintain distance from pinch points of operating equipment.
- Because heavy equipment may not be equipped with properly functioning reverse signal alarms, never turn your back on any operating equipment.

- Never climb onto operating equipment or operate contractor/subcontractor equipment.
- Never ride contractor/subcontractor equipment unless it is designed to accommodate passengers, and is equipped with a firmly attached passenger seat.
- Never work or walk under a suspended load.
- Never use equipment as a personnel lift; do not ride excavator buckets or crane hooks.
- Always stay alert and maintain a safe distance from operating equipment, especially equipment on cross slopes and unstable terrain.

6.4.3.16 Biological Hazards and Controls

Snakes

No poisonous snakes are indigenous to Puerto Rico.

Snakes typically are found in underbrush and tall grassy areas. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. DO NOT apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

Poison Ivy and Poison Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

Ticks

Ticks typically are in wooded areas, bushes, tall grass, and brush. Ticks are black, black and red, or brown, and can be up to one-quarter inch in length. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray only outside of clothing with permethrin or permanone and spray skin only with DEET. Check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to human resources. Look for symptoms of Lyme disease or Rocky Mountain spotted fever (RMSF). Indicators of Lyme disease: a rash might appear that looks like a bullseye with a small welt in the center. Indicators of RMSF: a rash of red spots might appear under the skin 3 to 10 days after the tick bite. In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

Bees and Other Stinging Insects

Bee and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and

inform the UXOSO and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

Bloodborne Pathogens

Exposure to bloodborne pathogens may occur when rendering first aid or cardio-pulmonary resuscitation (CPR), or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and PPE are required as specified in CH2M HILL SOP HS-36, Bloodborne Pathogens. Hepatitis B vaccination must be offered where exposure is a possibility.

Other Anticipated Biological Hazards

The following paragraphs identify the potential hazards associated with flora and fauna at the site. If additional concerns are identified, they will be added to this Site Safety Health Plan.

Hazardous Flora. Incidence of contact by individuals to poisonous and thorny plants is high, especially during surface water and sediment sampling activities; therefore, bare skin should be covered (i.e., long pants and shirt, steel-toed boots, leather or cotton gloves, safety glasses, and head protection) as much as practical when working in forested or densely vegetated areas. Personnel should avoid entering an area in the direct path of known poisonous flora; a secondary route should be selected. Care should also be taken when walking in such areas because uneven terrain or vines may present a tripping hazard.

While attempting to cut into dense underbrush, hazards exist from the sharp machete and gas-powered weed cutter. Therefore, care should be taken when using such devices. (Note: Hearing protection, steel-toed boots, gloves, and safety glasses are required when using weed cutters.) All rashes and other injuries will be reported to the UXOSO as soon as they are known.

Hazardous Fauna. Mosquitoes and sand flies pose a nuisance and physical hazard to field personnel; they distract workers, leading to accidents, and pose a physical threat by transmitting live microorganisms. Sand fly bites that are repeatedly scratched can cause secondary infections. Avoid the use of perfumes and scented deodorants, and don light-colored clothing. The use of Avon's "Skin So Soft" or other insect repellent is encouraged.

The potential exists to come in contact with other dangerous insects; these include centipedes, fire ants, bees, wasps, hornets, mites, fleas, and spiders. All personnel should perform "checks" on each other periodically and at the end of the work shift, especially when working in grassy or forested areas. All insect bites must be reported to the UXOSO.

No poisonous snakes are indigenous to Puerto Rico, only non-poisonous snakes such as the Boa Constrictor. Feral (wild) dogs and cats have been observed.

Mongeese, rats, and mice have been documented to (potentially) carry rabies. There is some evidence that mongeese can be infected with the rabies virus in an attenuated form, allowing them to carry and spread the virus for a considerable time before succumbing to the disease. Any observed unusual behavior by mongeese and other mammals must be reported. Signs of rabies can be characterized in two forms. Animals with furious rabies exhibit agitation and viciousness, followed by paralysis and death. Animals with dumb rabies exhibit lethargy and paralytic symptoms, followed by death. Behavioral indicators for both include fearlessness and change in nocturnal/diurnal rhythms.

Working in wet or swampy areas unprotected shall not be allowed because of the presence of a variety of etiologic (disease-causing agents). Contact with surface water will be kept to a minimum. There have been several incidents of infection by schistosomes (blood flukes) from contact with surface water. The aquatic snail vector, *Australorbis glabratus*, transmits the schistosomes into surface waters, predominantly drainage ditches. Even momentary contact (especially in the presence of blisters, cuts, and open sores) with contaminated surface water is sufficient to acquire an infection. Accidental skin contact requires that the area be washed with isopropyl alcohol (as directed by UXOSO). Symptoms of infection are fever, diarrhea, itchy skin, and central nervous system (CNS) damage. Schistosomiasis is hard to treat; once established in its host, it may remain for several years.

Before beginning site activities, each individual shall be questioned as to any known sensitivities to the previously mentioned organisms or agents.

Dengue Fever and Other Illnesses. According to the Centers for Disease Control (CDC), Dengue Fever is primarily a viral infection transmitted by mosquito bites in residential areas. The mosquitoes are most active during the day, especially around dawn and dusk, and are frequently found in and around human habitations. The illness is flu-like and characterized by sudden onset, high fever, severe headaches, joint and muscle pain, and rash. The rash appears 3 to 4 days after the onset of fever. Because there is no vaccine or specific treatment, prevention is important. To reduce mosquito bites, travelers should wear clothes that cover most of the body. Travelers should also take insect repellent with them to use on any exposed areas of skin. The most effective repellent is DEET (N,N-diethyl meta-toluamide). Avoid applying high-concentration DEET (greater than 35 percent) products to the skin and refrain from applying repellent to portions of the hands that are likely to come in contact with the eyes and mouth. Rarely, toxic reactions or other problems have developed after contact with DEET. Please note that personnel performing water sampling should refrain from using DEET because the breakdown products can show up as false positive results in lab analysis. For greater protection, clothing can be soaked in or sprayed with permethrin, which is an insect repellent licensed for use on clothing. If applied according to directions, permethrin will repel insects from clothing for several weeks.

Traveler's Diarrhea is the most frequent health problem for travelers. It can be caused by viruses, bacteria, or parasites that are found universally throughout the region. Transmission is most often through contaminated food or water. Purchase food and beverages from vendors that are professional. Avoid small roadside stands and drink bottled beverages when possible. The use of over-the-counter or prescriptions medications can reduce the length of the attack.

Hepatitis A is a viral infection of the liver transmitted by the fecal oral route; through direct person to person contact; from contaminated water, ice, or shellfish; or from fruits or uncooked vegetables contaminated through handling. Symptoms include fatigue, fever, loss of appetite, nausea, dark urine, jaundice, vomiting, aches and pains, and light stools. No specific therapy supportive care is available, only supportive care. The virus is inactivated by boiling or cooking to 85°C for 1 minute. Therefore, eating thoroughly cooked foods and drinking only treated water serve as general precautions. CDC recommends hepatitis A vaccine as a precaution.

Fire Ant Bites. Fire ants typically build mounds on the land surface that are usually easy to identify. Avoid disturbing these mounds. A bite from a fire ant can be painful but rarely is life threatening. It is possible, however, that the bite could cause an allergic reaction. If bitten, check for symptoms of an allergic reaction such as weakness, nausea, vomiting, dizziness, or shortness of breath. If symptoms appear, seek medical attention.

6.4.3.17 Radiological Hazards and Controls

Radiological hazards are not expected at this site. If new or additional information is provided that indicates that radiological hazards may be present, stop work and refer to CH2M HILL's Health and Safety Program, Program and Training Manual, and Health and Safety Program Radiation Protection Manual for SOPs in contaminated areas.

6.4.3.18 Chemical Warfare Materials

CWM is not expected at these work sites. If, at any time during the fieldwork, suspected CWM is encountered, the UXO team must stop all work activities immediately. Field sampling teams must withdraw from the site along the cleared approach paths, away from the area where the suspected CWM is found. The UXO team will immediately report the chemical event to the designated point of contact and the Contracting Officer, who will in turn notify Navy EOD team. A UXO team consisting of a minimum of two UXO qualified personnel will secure the suspected CWM discovery and stand by in an upwind location until relieved by a government representative. The initial exclusion zone for chemical weapons is 450 upwind per FM 9-15, Explosive Ordnance Disposal Service and Unit Operations. The UXO team will provide the point of contact with a Suspect CWM Report. If the government representative confirms the presence of CWM, he or she will report the chemical event to the appropriate agencies.

6.4.3.19 Contaminants of Concern

SWMU 4 – OB/OD Site. Previous investigations included the collection of soil and groundwater samples for VOCs, SVOCs, PCBs, and metals analysis. Parameters exceeding conservative long-term exposure risk based screening criteria in surface soils included aluminum, arsenic, iron, lead, thallium, vanadium, 2,4-dinitrotoluene, 2,4,6-trinitrotoluene, and hexahydro-1,3,5-trinitro-1,3,5,7-tetrazocine. In subsurface soils, the metals arsenic and barium exceeded screening criteria. Parameters exceeding screening criteria in groundwater included aluminum, barium, cadmium, chromium, iron, manganese, nickel, selenium, vanadium, and zinc. In addition, various small UXO and spent munitions were discovered at the site. The metals detected at the site were detected at concentrations indicative of background concentrations for the island. Table 6-3 shows potential exposure routes.

TABLE 6-3
Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 6.6.	**Inhalation**: Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 6.6 and 6.7, respectively.	**Other**: Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (e.g., wash hands and face before drinking or smoking).

6.5 Project Organization and Personnel

6.5.1 CH2M HILL Employee Medical Surveillance and Training

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated SSC have completed a 12-hour site safety coordinator course, and have documented requisite field experience. An SSC with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated "FA-CPR" are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed in Table 6-4 are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (e.g., confined-space entry) and contaminants (e.g., lead) may require additional training and medical monitoring.

TABLE 6-4
CH2M HILL Employees Currently in Medical Surveillance Program

Employee Name	Office	Responsibility	SSC/FA-CPR
Marty Clasen	TPA	Project Manager	Level D SSC; FA-CPR
Erik Isern	TPA	Field Team Leader	Level D SSC; FA-CPR
Keith Coats	TPA	Field Team Member	Level B SSC; FA-CPR
Fernando Ferreira	TPA	Field Team Leader	Level D SSC; FA-CPR
Karen Karvazy	TPA	Field Team Member	Level D; FA-CPR
Tunch Orsoy	TPA	Field Team Member	Level D; FA-CPR
Emiliano Cabale	TPA	Field Team Member	Level D; FA-CPR
Rick Gorsira	TPA	Field Team Leader	Level D SSC; FA-CPR
Ben Redmond	ORO	OE Manager	Level D; SUXOS; FA-CPR
Gary Webb	SEA	UXOSO	Level D; SUXOS; FA-CPR
George Overby	HSV	Field Team Member	Level D; UXO III; FA-CPR

Note: Lead awareness training is provided in Attachment 6-6 of this plan. The quiz must be completed successfully by project personnel exposed to lead during OE/UXO operations.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL's SOP HS-04, Reproduction Protection, including obtaining a physician's statement of the employee's ability to perform hazardous activities before being assigned field work.

6.5.2 Field Team Chain of Command and Communication Procedures

Client

Contact Name: Chris Penny, RPM, LANTDIV
Phone: (757) 322-4815
Facility Contact Name: Oscar Diaz, Refuse Manager
Phone: N/A

CH2M HILL

Project Manager: Marty Clasen/TPA
Health and Safety Manager: Michael Goldman/ATL
Field Team Leader and SSC: Erik Isern and Fernando Ferreira/TPA
UXOSO: Gary Webb/SEA

CH2M HILL Subcontractors

UXO Subcontractor: USA Environmental
Subcontractor Contact Name: John Q. Adams
Phone: (813) 884-5722

Geophysical Subcontractor: Blackhawk Geometrics
Subcontractor Contact Name: Jim Hild
Phone: (303) 278-8700

The subcontractors listed above are covered by this plan and must be provided a copy of it. This plan does not, however, address hazards associated with the tasks and equipment in which the subcontractor has expertise (e.g., UXO clearance). Subcontractors are responsible for the health and safety procedures specific to their work, and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established Health and Safety Plan(s). The CH2M HILL UXOSO or SSC should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s). CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and should include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SSC is responsible for confirming CH2M HILL subcontractor performance against both CH2M HILL's and the subcontractor's Site-Specific Health Plan.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan, and require them to sign the Employee Signoff Sheet included in Attachment 6-1.
- Ask subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent non-compliance/unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action; the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat non-compliance/unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.

- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify the subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety related communications in the project field logbook, daily reports, or other records.

Contractors

This plan does not address contractors who are contracted directly to LANTDIV. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and must never assume such responsibility through our actions (e.g., advising on safety and health issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so staff remain aware of appropriate precautions that apply to CH2M HILL. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 6-5 are to be used by the UXOSO or SSC to review the contractor's performance ***only*** as it pertains to evaluating our exposure and safety.

Safety and health-related communications with contractors should be conducted as follows:

- Ask the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor non-compliance/unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors:
  - Notify the contractor safety representative.
  - Request that the contractor determine and implement corrective actions.
  - If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify LANTDIV, Project Manager, and HSM as appropriate.
- If apparent contractor non-compliance/unsafe conditions or practices are observed, inform the contractor safety representative. CH2M HILL's obligation is limited strictly to informing the contractor of our observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. CH2M HILL's obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation; the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- Document all oral health and safety related communications in the project field logbook, daily reports, or other records.

6.6 Personal Protective Equipment (PPE)

Table 6-5 details the protective equipment necessary for various site tasks.

TABLE 6-5
Personal Protective Equipment

PPE SPECIFICATIONS [a]				
Task	**Level**	**Body**	**Head**	**Respirator [b]**
General site entry Surveying OE surveys and removals Observation of material loading for offsite disposal Oversight of remediation and construction	D	Work clothes; leather work boots [g]; work glove.	Hardhat [c] Safety glasses Ear protection [d]	None required
Tasks requiring OE/UXO anomaly reacquisition in contamination area	Modified D	Work clothes or cotton coveralls Boots: chemical-resistant boots [g] OR steel-toed, leather work boots with outer rubber boot covers Gloves: Inner surgical-style nitrile and outer chemical-resistant nitrile gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required
Tasks requiring upgrade or downgrade for reasons presented below	C	Coveralls: Polycoated Tyvek® Boots: chemical-resistant boots [g] OR leather work boots [g] with outer rubber boot covers Gloves: Inner surgical-style nitrile and outer chemical-resistant nitrile gloves.	Hardhat c Splash shield [c] Ear protection [d] Spectacle inserts	APR, full face, MSA Ultratwin or equivalent; with GME-H cartridges or equivalent.

Reasons for Upgrading or Downgrading Level of Protection	
Upgrade [f]	**Downgrade**
• Request from individual performing tasks • Change in work tasks that will increase contact or potential contact with hazardous materials • Occurrence or likely occurrence of gas or vapor emission • Known or suspected presence of dermal hazards • Instrument action levels (Section 6.7) exceeded	• New information indicating that situation is less hazardous than originally thought • Change in site conditions that decreases the hazard • Change in work task that will reduce contact with hazardous materials

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the UXOSO. UXO technicians are required to wear hard hats except when investigating suspect UXO.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 ft or less without shouting.
[e] Cartridge change-out schedule is at least every 8 hours (or one work day), except if relative humidity is >85 percent, or if organic vapor measurements are > midpoint of Level C range (refer to Section 6.7)--then at least every 4 hours. If encountered conditions are different than those anticipated in this HSP, contact the HSM.
[f] Performing a task that requires an upgrade to a higher level of protection (e.g., Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM, and an UXOSO or SSC qualified at that level is present.
[g] Steel-toed boots are not required during surface geophysical mapping.

6.7 Air Monitoring/Sampling

6.7.1 Air Monitoring Specifications

Table 6-6 shows relevant air monitoring specifications.

TABLE 6-6
Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]		Frequency[b]	Calibration
PID: Organic Vapor Monitor (OVM) with 10.6eV lamp or equivalent	OE/UXO anomaly reacquisition in contaminated areas	0 – 1 parts per million (ppm) >1 – 5 ppm > 5 ppm	Level D Level C Stop Work	Initially and periodically during task	Daily

[a] Action levels apply to sustained breathing-zone measurements (2 minute duration) above background.
[b] The exact frequency of monitoring depends on field conditions and is to be determined by the UXOSO SSC; generally, every 5 to 15 minutes is acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (e.g., "Breathing Zone/MW-3", "at surface/SB-2", etc.).

6.7.2 Calibration Specifications

Table 6-7 shows calibration specifications.

TABLE 6-7
Calibration Specifications

PID: OVM, 10.6 or 11.8 eV bulb	100 ppm isobutylene	RF = 1.0	100 ppm	1.5 lpm reg T-tubing
PID: MiniRAE, 10.6 eV bulb	100 ppm isobutylene	CF = 100	100 ppm	1.5 lpm reg T-tubing

6.7.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other OSHA regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain VOCs. Contact the HSM immediately if these contaminants are encountered.

Results must be sent immediately to the HSM. Regulations may require reporting to monitored personnel.

6.8 Decontamination

The UXOSO or SSC must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the UXOSO or SSC. The UXOSO or SSC must ensure that procedures are established for disposing of materials generated on the site.

6.8.1 Decontamination Specifications

Table 6-8 shows the general decontamination specifications.

TABLE 6-8
Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
• Boot wash/rinse • Glove wash/rinse • Outer-glove removal • Body-suit removal • Inner-glove removal • Respirator removal • Hand wash/rinse • Face wash/rinse • Shower immediately • Dispose of PPE in municipal trash, or contain for disposal • Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal	• Wash/rinse equipment • Solvent-rinse equipment • Contain solvent waste for offsite disposal	• Power wash • Steam clean • Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

6.8.2 Diagram of Personnel Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The UXOSO or SSC should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-1 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the UXOSO or SSC to accommodate task-specific requirements.

6.9 Spill Prevention and Containment Procedures

This section establishes minimum site requirements. Subcontractors are responsible for spill prevention and control related to their operations. Subcontractors' written spill prevention and control procedures must be consistent with this plan. All spills must be reported to the supervisor, site manager, and PM.

6.9.1 Spill Prevention

All fuel and chemical storage areas will be properly protected from onsite and offsite vehicle traffic. Fuel storage tanks must be equipped with secondary containment. Fuel tanks must be inspected daily for signs of leaks. Accumulated water must be inspected for signs of product before discharge.

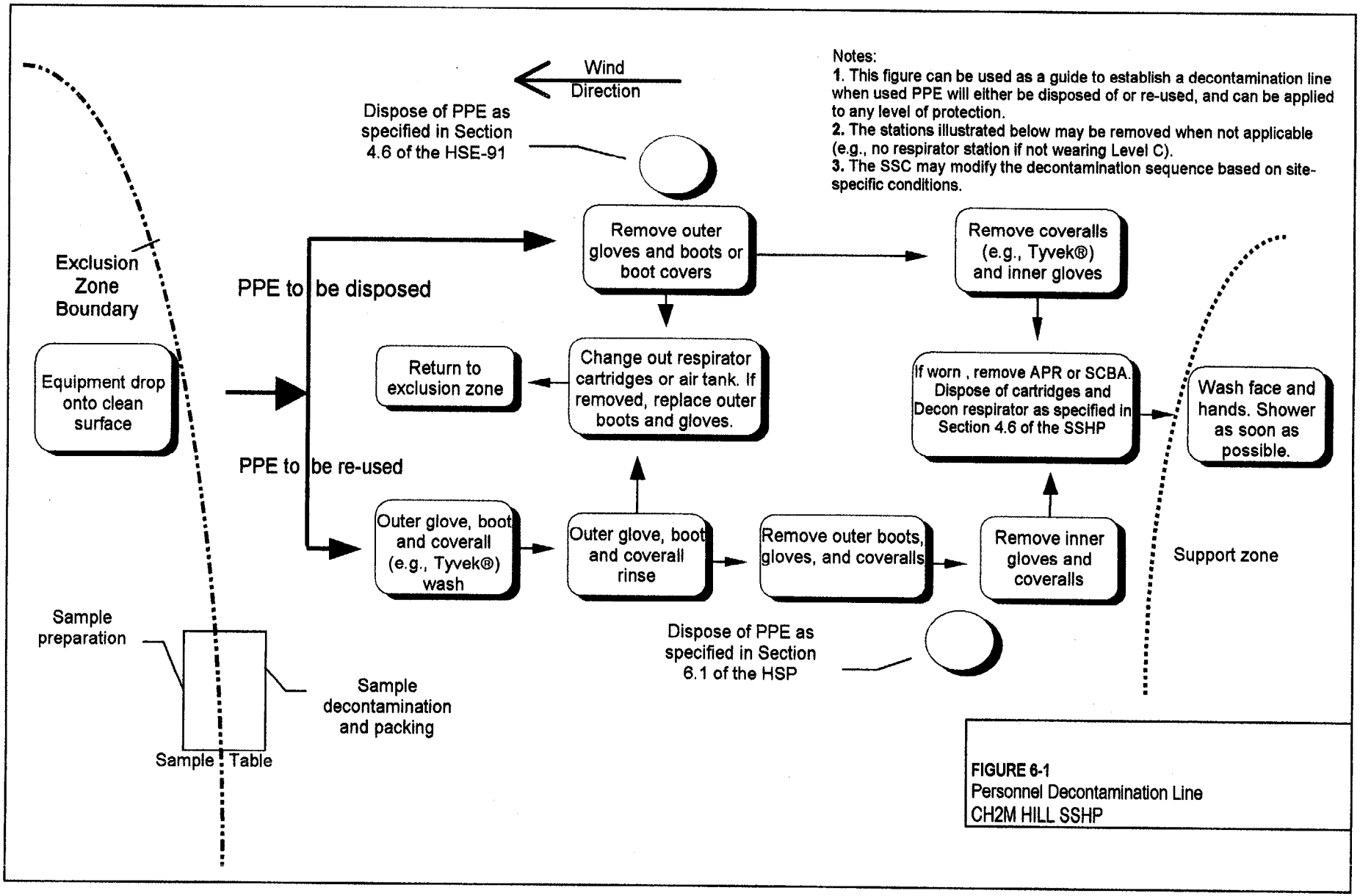


FIGURE 6-1
Personnel Decontamination Line
CH2M HILL SSHP

Incidental chemical products must be properly stored, transferred, and used in a safe manner. If chemical product use occurs outside areas equipped with spill control materials, adequate spill control materials must be maintained.

6.9.2 Spill Containment and Control

Spill control materials will be maintained in the support zone and at fuel storage and dispensing locations. Incidental spills will be contained with sorbent and disposed of properly. Spilled materials must be immediately contained and controlled. Spill response procedures include taking the following actions:

- Immediately warn any nearby personnel and notify the work supervisor.
- Assess the spill area to ensure that it is safe to approach. Activate site evacuation signal if the spill presents an emergency.
- Ensure that any nearby ignition sources are immediately eliminated.
- If it can be done safely, stop the source of the spill.
- Establish site control for the spill area.
- Use proper PPE in responding to the spill.
- Contain and control spilled material through the use of sorbent booms, pads, or other materials.

6.9.3 Spill Clean-up and Removal

All spilled material, contaminated sorbent, and contaminated media will be cleaned up and removed as soon as possible. Contaminated spill material will be drummed, labeled, and properly stored until material is disposed of. Contaminated material will be disposed of according to applicable federal, state, and local requirements. Contact the regulatory compliance person for the project or the program for assistance.

6.10 Site Control Plan

6.10.1 Site Control Procedures

- The UXOSO or SSC will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for onsite safety briefing include a general discussion of this section, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, and emergencies.
- The UXOSO or SSC records attendance at safety briefings in a logbook and documents the topics discussed.
- Post the OSHA job-site poster in a central and conspicuous location in accordance with CH2M HILL SOP HS-71, OSHA Postings.

- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the "buddy system."
- Initial air monitoring is conducted by the UXOSO or SSC in appropriate level of protection.
- The UXOSO or SCC is to conduct periodic inspections of work practices to determine the effectiveness of this plan: refer to Sections 6.2 and 6.3. Deficiencies are to be noted, reported to the HSM, and corrected.

6.10.2 Hazwoper Compliance Plan

Certain parts of the site work are covered by state or federal Hazwoper standards and therefore require training and medical monitoring. Anticipated Hazwoper tasks (Section 6.2.1.1) might occur consecutively or concurrently with respect to non-Hazwoper tasks. This section outlines procedures to be followed when approved activities specified in Section 6.2.1.2 do not require 24- or 40-hour training. Non-Hazwoper-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-Hazwoper-trained personnel are allowed onsite, or while non-Hazwoper-trained staff are working near Hazwoper activities. Other data (e.g., soil) also must document that no potential exists for exposure. The HSM must approve the interpretation of these data. *Draft Final OE Master Work Plan* subsections 6.4.3.20 and 6.7 address contaminant data and air sampling requirements, respectively.
- When non-Hazwoper-trained personnel are at risk of exposure, the SSC must post the exclusion zone and inform non-Hazwoper-trained personnel of the following:
  - Nature of the existing contamination and its locations
  - Limitations of their access
  - Emergency action plan for the site
- Periodic air monitoring with direct-reading instruments conducted during regulated tasks also should be used to ensure that non-Hazwoper-trained personnel (e.g., in an adjacent area) are not exposed to airborne contaminants.
- When exposure is possible, non-Hazwoper-trained personnel must be removed from the site until it can be demonstrated that a potential for exposure to health and safety hazards no longer exists.

- Remediation treatment system start-ups: Once a treatment system begins to pump and treat contaminated media, the site is (for the purposes of applying the Hazwoper standard) considered a treatment, storage, and disposal facility (TSDF). Therefore, once the system begins operation, only Hazwoper-trained personnel (minimum of 24 hours of training) will be permitted to enter the site. All non-Hazwoper-trained personnel must not enter the TSDF area of the site.

6.11 Emergency Response Plan

6.11.1 Pre-Emergency Planning

The UXOSO or SSC will perform the applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the facility, and local emergency service providers as appropriate. These tasks include:

- Review the facility emergency and contingency plans where applicable.
- Determine what onsite communication equipment is available (e.g., two-way radio, air horn).
- Determine what offsite communication equipment is needed (e.g., nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Field Trailers: Post "Exit" signs above exit doors, and post "Fire Extinguisher" signs above locations of extinguishers. Keep areas near exits and extinguishers clear.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to LANTDIV, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Designate one vehicle as the emergency vehicle; place hospital directions and map inside; keep keys in ignition during field activities.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The UXOSO or SSC will evaluate emergency response actions and initiate appropriate follow-up actions.

6.11.2 Emergency Equipment and Supplies

The UXOSO or SSC should mark the locations of emergency equipment on the site map and post the map, as illustrated in Table 6-9.

TABLE 6-9
Sample Supply List and Locations

Emergency Equipment and Supplies	Location
20 pound (lb) (or two 10-lb) fire extinguisher (A, B, and C classes)	Support Zone/Heavy Equipment
First aid kit	Support Zone/Field Vehicle
Eye Wash	Support & Decon Zone/Field Vehicle
Potable water	Support & Decon Zone/Field Vehicle
Bloodborne pathogen kit	Support Zone/Field Vehicle
Additional equipment (specify)	N/A

6.11.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

Instead of implementing a work-area evacuation, note that small fires or spills posing minimal safety or health hazards may be controlled.

6.11.4 Emergency Medical Treatment

The procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources. If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. The UXOSO or SCC will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room. During non-emergencies, follow these procedures, as appropriate:

- Notify appropriate emergency response authorities listed in Section 6.11.8 (e.g., 911).
- Prevent further injury.
- Initiate first aid and CPR where feasible.
- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.

- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.
- Report incident as outlined in Section 6.11.7.

6.11.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the UXOSO or SSC before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The UXOSO or SSC and a "buddy" will remain onsite after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The UXOSO or SSC will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).
- The UXOSO or SSC will write up the incident as soon as possible after it occurs and submit a report to the Director of Health and Safety.

6.11.6 Evacuation Signals

Table 6-10 provides examples of possible evacuation signals.

TABLE 6-10
Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency-help me.
Thumbs up	OK; understood.
Grasping buddy's wrist	Leave area now.
Continuous sounding of horn	Emergency; leave site now.

6.11.7 Incident Notification and Reporting

- Upon any project incident (fire, spill, injury, near miss, death, etc.), immediately notify the PM and HSM. Call emergency beeper number if HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help Human Resources administrator complete an Incident Report Form (IRF). IRF must be completed within 24 hours of incident.

- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to LANTDIV as required in contract.

6.11.8 Emergency Contacts (complete during project start-up)

24-hour CH2M HILL Emergency Beeper – 888/444-1226	
Medical Emergency – 911 Facility Medical Response #: Local Ambulance #: (787) 741-2151	CH2M HILL Medical Consultant Dr. Peter Greaney GMG WorkCare, Orange, CA (800) 455-6155 (After hours calls will be returned within 20 minutes)
Fire/Spill Emergency – 911 Facility Fire Response #: Local Fire Dept #: (787) 741-2111	Local Occupational Physician
Security & Police – 911 Facility Security #: (787) 741-0615 Local Police #: (787) 741-2020	Corporate Director Health and Safety Name: Mollie Netherland/SEA Phone: (206) 453-5005 24-hour emergency beeper: (888) 444-1226
Utilities Emergency Water: Gas: Electric:	Health and Safety Manager (HSM) Name: Michael Goldman Phone: (770) 604-9182 (office) ext 592; (770) 335-2076 (Cell) Pager: (888) 856-9114
Site Safety Coordinator (SSC) Name: Erik Isern Phone: (813) 874-6522, Ext. 4313	Regional Human Resources Department Name: Mary Jo Jordan Phone: (352) 335-5877
Project Manager Name: Martin Clasen Phone: (813) 874-6522, Ext. 4307	Corporate Human Resources Department Name: John Monark/COR Phone: (303) 771-0900
Federal Express Dangerous Goods Shipping Phone: (800) 238-5355 CH2M HILL Emergency Number for Shipping Dangerous Goods Phone: (800) 255-3924	Worker's Compensation and Auto Claims Sterling Administration Services Phone: (800) 420-8926 After hours: (800) 497-4566 Report fatalities and report vehicular accidents involving pedestrians, motorcycles, or more than two cars.
Federal Agency/Contact Name:	Phone:
State Agency/Contact Name:	Phone:
Local Agency/Contact Name:	Phone:
Contact the Project Manager. Generally, the Project Manager will contact relevant government agencies.	
Facility Alarms:	Evacuation Assembly Area(s):
Facility/Site Evacuation Route(s):	
Hospital Name/Address: NSRR	Hospital Phone #: (787) 741-2151
Directions to Hospital	
For minor first aid, proceed to public works Camp Garcia infirmary. For extreme or life threatening emergencies, call for helicopter from NSRR, (787) 865-5997.	

6.12 Approval

This SSHP has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified, and must be amended if those conditions change.

6.12.1 Original Plan

Written By: Gary Webb Date: 07/23/01

Approved By: Michael Goldman Date: 7/23/01

6.12.2 Revisions

Revisions Made By: _____ Date: _____

Revisions to Plan: _____

Revisions Approved By: _____ Date: _____

6.13 Attachments

Attachment 6-1: Employee Signoff Form – Site Safety and Health Plan

Attachment 6-2: CH2M HILL HSE-91, OE SOP

Attachment 6-3: Project-Specific Chemical Product Hazard Communication Form

Attachment 6-4: Chemical-Specific Training Form

Attachment 6-5: Applicable Material Safety Data Sheets

Attachment 6-6: Lead Awareness Training

ATTACHMENT 6-1

CH2MHILL

EMPLOYEE SIGNOFF FORM

Site Safety and Health Plan

The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this FSI, have read and understood it, and agree to abide by its provisions.

Project Name: Project Number:

EMPLOYEE NAME (Please print)	EMPLOYEE SIGNATURE	COMPANY	DATE

ATTACHMENT 6-2

CH2MHILL

Ordnance Explosives (OE)
Standard of Practice HSE- 91

Note:

This Standard of Practice covers the entire spectrum of OE/UXO-related project activities, including investigation and removal.

For this specific project, "Initial Ordnance and Explosives Site Assessment for SWMU 4 at the Former NASD," the removal tasks described in Sections 4.2.2.(b), 4.2.3.(d), and 4.2.7 of this Standard of Practice will be conducted by NSRR EOD personnel and may not apply to this project.

ATTACHMENT 6-3

CH2MHILL

Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SSC shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: NASD Vieques

Project Number:

MSDSs will be maintained at the following location(s):

No chemicals are expected to be used as part of the OE surveys and removals. If chemicals are brought to the site for use during the investigation, the chemicals will be added to this form and the appropriate MSDS Sheets will be attached to this plan.

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard

Refer to SOP HS-05 Hazard Communication for more detailed information.

ATTACHMENT 6-4

CH2MHILL

CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project # :
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

☐ Physical and health hazards

☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)

☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

ATTACHMENT 6-5: APPLICABLE MATERIAL SAFETY DATA SHEETS

To be inserted at project start up.

ATTACHMENT 6-6: LEAD AWARENESS

Lead Exposure Training Instructions

This module was designed for employees who work in areas with percent levels of inorganic lead or areas where there is a potential lead exposure above the action level of 30 $\mu g/m^3$.

Lead Exposure Training Program

The OSHA lead standard (29 CFR 1910.1025) requires employers to provide lead training for those employees who may be exposed to inorganic lead above the action level of 30 $\mu g/m^3$. This training program satisfies this OSHA requirement and is provided to assist employees in recognizing lead exposure hazards and understanding the procedures to be followed to minimize exposure.

Objectives

- Inform employees of the possible adverse health effects of lead exposure
- Inform employees of the regulatory requirements when working with or around lead
- Identify how lead exposures could occur on CH2M HILL projects

How to complete this training

Employees are required to read the training materials that follow and complete a short quiz. The training materials must be read thoroughly and understood before completing the quiz; you will have only one chance at answering each question.

Quiz scores will automatically be sent to the Health and Safety Training Administrator. A minimum score of 70 percent must be obtained to receive credit for this training. If a passing score is obtained, the H&S Training Administrator will issue you a certificate of completion. If a passing score is not obtained, you are required to contact your regional health and safety program manager to discuss the training material directly.

Lead Exposure Training

1. Uses And Occurrences

Lead is a well-known naturally-occurring metal found in the earth's crust, often associated with silver and zinc. It has had a variety of uses since antiquity, but its greatest use today is in car batteries. It was formerly used in gasoline, water pipes, pottery glazes, paint, solder, and as metal alloy. It currently has a variety of other uses such as radiation shielding, as vibration dampening material, in explosives, bullets, magnets, and in electronic equipment. It is also a common contaminant at hazardous waste sites.

2. Physical Characteristics

Lead exist as the familiar soft, dull gray metal, as a white or red solid as lead oxide, a gray or black solid as lead sulfide (galena), a white solid as lead sulfate, all which are insoluble in water. There are numerous other forms of inorganic lead. The organic forms, tetraethyl lead and tetramethyl lead, used in the past in fuels, are flammable colorless liquids also insoluble in water.

3. Toxicity and Hazards

Lead is a highly toxic substance that has a variety of adverse health effects from both chronic and acute exposure. An acute exposure to high levels of lead can cause a brain condition known as encephalopathy which can lead to death in a few days. The more common chronic exposure can also cause brain damage, blood disorders (anemia), kidney damage, damage to the reproductive system of both men and women and toxic effects to fetuses. Lead is stored in the bones and eliminated from the body very slowly. Consequently, exposures to low levels over many years can cause these adverse health effects. Lead is toxic by inhalation and ingestion, but is not absorbed through the skin. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in mouth, anxiety, insomnia and muscle and joint pain or soreness.

4. Regulations

Inorganic lead has been specifically regulated in general industry by OSHA since 1981 (29 CFR 1910.1025) and in construction (29 CFR 1926.62) since 1994. The 8-hour permissible exposure limit is 50 $\mu g/m^3$. There is no short-term exposure limit. OSHA also specifies an action level of 30$\mu g/m^3$. These limits apply to both general industry and construction. Initial air monitoring must be done whenever there are indications of lead exposure above the action level. If the action level is not exceeded, air monitoring can cease. If the action level is exceeded, initial blood lead level monitoring must be made available. If exposed above the action level for more than 30 days in a year, medical surveillance must be provided which includes further blood lead level monitoring and a medical examination. If specified blood levels are exceeded, the employee must be removed from the job or task where lead exposure occurs. Training must also be provided. If the PEL is exceeded, engineering controls must be implemented to reduce exposure. If engineering controls are not feasible or ineffective, respirators must be provided and worn. Air-purifying respirators with high-efficiency (HEPA) filters can be worn when airborne levels are as high as 500 $\mu g/m^3$. If levels exceed this amount, supplied air respirators must be worn. In addition, if the PEL is

exceeded, OSHA requires the establishment of regulated areas, showers, change rooms, separate clean lunchrooms and warning signs. Regulated areas are demarcated from the rest of the workplace to limit access to authorized personnel who have received lead training. To enter a regulated area you must also wear protective clothing. Tetraethyl and tetramethyl lead each have separate PELs of 100 $\mu g/m^3$ and 150 $\mu g/m^3$ respectively, and are not covered under the inorganic lead regulation.

5. How Exposures Can Occur At CH2M HILL Projects

Exposure to lead can occur at hazardous waste sites where lead is found in soil or groundwater and at old mining sites or former smelter sites. Exposure to lead-containing dust could occur during drilling, heavy equipment movement or other soil-disturbing activities. Dust formation can be minimized by wetting soils. Exposure could also occur during lead paint removal activities, during welding on metal surfaces with lead-containing paint, or in project work in smelters, battery recycling or manufacturing plants or at some mines.

6. Additional Information

Persons working at hazardous waste sites with known high amounts in soils (3 percent or 30,000 ppm) should have blood lead draws taken before and after site work. Air sampling should be done during soil disturbing activities at the site. Person working at non-hazardous waste site who have information or suspect they have been exposed to lead above the action level should contact a health and safety manager to determine if medical monitoring is needed or other regulatory requirements apply.

Lead Quiz

1. Which of the following is not a mode of entry of lead?
   A. Inhalation
   B. Ingestion
   C. Skin absorption
   D. All of the above are modes of entry

2. Which of the following is not a common symptom of lead exposure?
   A. Loss of appetite
   B. Metallic taste in mouth
   C. Muscle and joint pain or soreness
   D. All are common symptoms of lead exposure

3. What are the OSHA exposure limits for lead (PEL and action level)?
   A. 50 $\mu g/m^3$ and 25 $\mu g/m^3$ respectively
   B. 50 ppm and 25 ppm respectively
   C. 50 ppm and 30 ppm respectively
   D. 50 $\mu g/m^3$ and 30 $\mu g/m^3$ respectively

4. When is air monitoring required for lead exposures?
   A. When exposed to lead for 30 days or more in a year
   B. Anytime lead is present in the workplace
   C. When there are indications of lead exposure above the action level
   D. When the PEL is exceeded

5. When must medical surveillance be made available for lead exposures?
   A. When the action level is exceeded
   B. When the action level is exceeded for 30 days in a year
   C. When the PEL is exceeded
   D. When the PEL is exceeded for 30 days in a year

6. When is respiratory protection required for lead exposures?

   A. When the action level is exceeded

   B. When the action level is exceeded for 30 days in a year

   C. When engineering controls do not reduce exposure below the PEL

   D. When the PEL is exceeded for 30 days in a year

7. What respiratory protection is considered acceptable for protection against lead exposures?

   A. Air-purifying with organic vapor cartridge

   B. Air-purifying with HEPA cartridge

   C. Air-purifying with lead cartridge

   D. Supplied-air respirator is the only acceptable respiratory protection

8. What are the requirements for entering a lead-regulated area?

   A. Must be an authorized person

   B. Must complete lead training

   C. Must wear protective clothing

   D. All of the above

9. What control measure should be used to minimize dust formation when disturbing lead-containing soil?"

   A. Training

   B. Wetting the soil

   C. Air purifying respirators

   D. None of the above

10. What level of lead in the soil might require a lead blood test?

   A. 1% or 10,000 ppm

   B. 3% or 30.000 ppm

   C. 5% or 50,000 ppm

   D. None of the above

SECTION 7

Location Surveys and Mapping Plan

Survey and mapping tasks are key components of the OE investigations for identifying the location of each OE and UXO component in the field, reporting the locations of these components on maps and in spatial queries conducted in the GIS, and assisting with disposition of OE and UXO components. The Location Surveys and Mapping Plan describing the methods, equipment, and accuracy requirements for location surveys and mapping for the OE and UXO survey and anomaly reacquisition at the Former NASD is described in detail in Section 7 of the *Draft Final OE Master Work Plan.*

SECTION 8

Sampling and Analysis Plan

Sampling and analysis procedures for projects at the Former NASD were documented in the *Master Work Plan for the Former NASD* (CH2M HILL, January 2001). Environmental sampling at OE sites will be conducted in accordance with the January 2001 *Master Work Plan.* Environmental sampling locations will be identified in the site-specific CERCLA Investigation Work Plan that will be developed for each site after completion of the UXO survey. A copy of the January 2001 *Master Field Sampling Plan* was provided in Appendix A of the *Draft Final Master OE Work Plan* for reference.

No environmental sampling will occur until the remedial investigation (RI) for SWMU 4 has begun. All UXO investigations will be completed prior to the RI.

SECTION 9

Quality Control Plan

The *Quality Control Plan* (QCP) for OE removal actions at the Former NASD is documented in Section 9 of the *Draft Final Master OE Work Plan for the Former NASD*. Details regarding the QCP are included in that section and should be referenced for QC measures associated with OE removal actions at SWMU 4.

Résumés of key personnel included in this program are provided in Appendix B of this site-specific work plan. Personnel qualification verification forms (Form 9-1) are provided as Appendix C to this document.

9.1 Project Schedule

The proposed schedule for implementation of each stage of the UXO investigation is presented below. The duration of each stage of the project schedule corresponds to Table 5-1 of the *Draft Final Site Management Plan for SWMU 4* (CH2M HILL, August 2001) and is expressed in calendar days.

Project Startup. This stage includes preparation of project submittals that include this Work Plan. This Work Plan includes the Site Safety and Health Plan, the Explosives Management Plan, IDW Management Plan, QCP, and Project Schedule. Estimated Duration – 60 Days.

Preparatory Activities. This stage includes any permitting or subcontractor procurements as necessary. Estimated Duration – 60 Days.

Field Investigations. This stage includes mobilization, geophysical survey, ordnance identification, certification, and disposal of OE/UXO materials, OE/UXO related scrap, and no OE/UXO related scrap. Estimated Duration – 180 days.

Site Restoration. This stage includes grading and re-vegetation activities at excavation areas. Estimated Duration – 7 Days.

Project Closeout Report. This stage includes preparation of a report documenting the results of all OE/UXO activities conducted at SWMU 4. Estimated duration – 120 Days.

9.2 Geophysical Plan

The geophysical plan and associated qualifications for personnel will be provided as an addendum to the final version of this work plan document.

SECTION 10

Environmental Protection Plan

Based on the findings of the habitat characterization study conducted during the *Phase I Expanded PA/SI for the Former NASD*, no threatened or endangered plant or animal species are expected to be impacted by the proposed UXO work at SWMU 4.

In the event that any natural or archeological resource is to be impacted by the investigation, the Environmental Resource Manager (DoI) will be contacted. For a description of the environmental features of the Former NASD, refer to the *Draft Final OE Master Work Plan*.

SECTION 11

Investigation-Derived Waste Management Plan

This *IDW Management Plan* describes the handling of materials during OE removal and HTRW activities, and was developed in accordance with NAVSEA OP5, Ammunition and Explosives Ashore: Safety Regulations for Handling, Storing, Production, Renovation, and Shipping and DoD 4160.21-M, Defense Reutilization and Marketing Manual. IDW procedures for environmental investigations at the Former NASD were addressed in the *Final Master Work Plan for NASD* (CH2M HILL, January 2001). Additional information for the UXO investigations is provided in the *Draft Final OE Master Work Plan* and should be referenced accordingly for appropriate IDW handling procedures. IDW management will not be applicable until implementation of the RI at SWMU 4.

SECTION 12

Geographical Information System Plan

The *GIS Plan* provided in Section 12 of the *Draft Final OE Master Work Plan* describes the incorporation of GIS into the data management phases of OE anomaly validation actions at the Former NASD. This plan was developed in accordance with OE MCX data item description (DID) OE-005-14. A comprehensive presentation of the database deliverables is presented in the *Draft Final OE Master Work Plan.*

SECTION 13

References

A.T. Kearney, Inc. and K.W. Brown & Associates, Inc. *Phase II RCRA Facility Assessment of the Naval Ammunition Facility, Vieques Island, Puerto Rico.* October 1988.

CH2M HILL, Inc. *Draft Final Ordnance/Explosives Master Work Plan, Former U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico. October* 2001.

CH2M HILL, Inc. *Draft Magazine Siting Plan for Solid Waste Management Unit-4, Former U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico. October* 2001.

CH2M HILL, Inc. *Draft Final Site Management Plan, Former U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico. August* 2001.

CH2M HILL, Inc. *Final Master Work Plan, Former U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico.* January 2001.

CH2M HILL, Inc. *Findings of Suitability of Early Transfer, Former U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico. November* 2000.

CH2M HILL, Inc. *Phase I Expanded Preliminary Assessment/Site Investigation, U.S. Naval Ammunition Support Detachment, Vieques Island, Puerto Rico.* October 2000.

Greenleaf/Telesca Planners, Engineers, Architects, Inc., and Ecology and Environment, Inc. *Initial Assessment Study: Naval Station Roosevelt Roads, Puerto Rico.* September 1984.

NASD. *Federally Listed Species Occurring or Potentially Occurring at Vieques, Puerto Rico.* 1996.

Program Management Company. *Environmental Baseline Survey, Naval Ammunition Support Detachment: Vieques Island, Puerto Rico.* October 2000.

APPENDIX A

ORS Metal Collection and Inspection Procedures

Ordnance Related Scrap (ORS) Metal Collection and Inspection Procedures

Contents

List of Figures

1.0 Purpose

This SOP is intended to guide UXO Technicians in the safe and efficient handling and disposal of OE/UXO related scrap metal found at CH2M HILL project sites. The inherently dangerous characteristics of AEDA dictate that special precaution be taken to ensure that demilitarization is performed only by properly trained and technically qualified personnel.

2.0 Background

During excavation and investigation operations, UXO Technicians will encounter the following types of metallic contamination: UXO items; ordnance related scrap that is contaminated with explosives or other hazardous materials; non-hazardous ordnance related scrap metal; and general metallic debris. Because the metal scrap recovered will ultimately be disposed of offsite, it is imperative that procedures be established to preclude live ordnance or hazardous materials from becoming intermingled with other non-hazardous metal scrap.

Current and past practices have only required the inspection of OE related scrap and a certification by a qualified EOD/UXO technician that it is safe to the best of their knowledge. There are several pitfalls with this approach depending on the type of ordnance being inspected. The following paragraphs provide guidance for avoiding these pitfalls.

References:

DoD 4160.21-M: Department of Defense Reutilization and Marketing Manual

DoD 4160.21-M-1: Department of Defense Demilitarization Manual

TB 700-4: Department of the Army Technical Bulletin - Decontamination of Facilities and Equipment

3.0 Collection Procedures

We will use a systematic approach for collecting and inspecting metal scrap. Our approach is designed to ensure that the materials undergo a continual evaluation/inspection process from the time acquired until finally removed from the site.

At the operating site, we will preposition two scrap metal containers. One container will be marked "Non-OE Scrap Metal" and will be used to collect general metal debris. The other container will be marked "Ordnance Related Scrap Metal" and will be used to collect non-hazardous ordnance related scrap metal (i.e. Metal components that do not contain any explosives or other hazardous materials).

Collection procedures begin at the time the metal item is discovered by the UXO Technician. At this point the UXO Technician makes a preliminary determination as to the classification of the item. If the item is identified as non-ordnance related scrap it is placed in a temporary Non-OE scrap pile located within the current operating grid. If the item is identified as

ordnance related scrap it is placed in a temporary ordnance related scrap pile, again this pile is located within the current operating grid.

Upon completion of operations within a grid, the UXO Supervisor for the team that cleared the grid will inspect each of the scrap piles and direct movement of the scrap into the appropriate site collection container. To preclude migration of the material from one pile to the other during movement to the scrap containers, each pile will be moved as a distinct and separate vehicle load.

4.0 Removal of Scrap Metal/Range Residue

The UXO Excavation and Disposal Team will collect the scrap piles deposited at the gird corner markers by the UXO Clearance Team, perform an inspection to confirm that segregation of the OE related scrap had been done correctly and that no live UXO has been placed in the OE related scrap pile. The OE related scrap will be inspected and divided into two groups: 1) OE related scrap requiring further demilitarization; and 2) OE related scrap that does not require further demilitarization. **Figure 1** is a Logic Diagram for the Collection and Disposition of OE Related Scrap.

4.1 Segregation of Scrap Metal/Range Residue

For purposes of disposal, it shall be segregated and defined as either Group 1a, Group1b, or Group 2.

4.1.1 Group 1 Scrap Metal/Range Residue

Group 1 includes property that previously contained explosives or that does not contain items of a dangerous nature and can be certified inert and/or free of explosives or other dangerous materials such as targets, certain expended ordnance, etc.

4.1.1.1 Group 1a Scrap Metal/Range Residue

Group 1a includes firing range expended small arms cartridge and inert metals gleaned from range clean up. Metals gleaned include material for which the only use is for its basic material content (e.g. clean shrapnel, target metal, etc.) And does not include material with any residual utility or capability or that is considered to be MLI or CCLI. Such material is eligible under the Resource Recovery and Recycling Program for disposition by a QRP in accordance with DODI 7514.1, Pollution Prevention. DOD Components may exercise direct sale authority for firing range expended small arms cartridge cases provided that it is crushed, shredded or otherwise destroyed prior to release from DOD control.

4.1.1.2 Group 1b Scrap Metal/Range Residue

Group 1b includes any certifiable material or item not meeting the criteria in 1a above. A determination shall be made as to whether the material/item requires demilitarization. Damaged sustained does not necessarily constitute demilitarization. Destruction shall, at a minimum, satisfy the provisions of DOD 4160.21-M-1. This material is not eligible for a QRP.

4.1.2 Group 2 Scrap Metal/Range Residue

Group 2 includes inherently dangerous items that may potentially contain munitions residue and cannot be certified as inert, such as practice bombs (that is, Aduds,≅ unexploded ordnance (UXO), BDU-33, MK-106, etc.)

5.0 Disposition of Munitions List Items (MLI)

Demilitarization should be accomplished by the most cost effective method consistent with adequate security and surveillance as economically as practical in accordance with existing environmental standards, safety and operational regulations, to the point of assuring freedom from explosives, toxic or incendiary materials, smoke content or design hazards by one of the following methods:

a) By a sales contractor, as a condition of sale. Unless otherwise authorized, property to be demilitarized by this manual must be demilitarized prior to transfer of title to a purchaser.

b) By the DRMO, generating activity, designated Military Service/Defense Agency or contractor personnel (having qualified UXO personnel).

c) Under a service/performance contract.

5.1 Assignment of Demilitarization Codes

The proper procedure requires that OE scrap be assigned a demilitarization code and that code determines the type of processing required. For almost all OE scrap the assigned code should be AG≅. Assignment of this code is the responsibility of the generating activity (for range maintenance contracts such as Fort Irwin it is the National Training Command; for base realignment and closure (BRAC) removal actions it is the BRAC office; and for formerly used defense sites (FUDS) it is the Corp of Engineers). CH2M HILL as the contractor and expert in OE should assist the generating activity in determining the demilitarization code to be assigned and the method and degree of demilitarization required.

Definition of Demilitarization Code AG≅:

AG≅ MLI -- Demilitarization required - AEDA, Demilitarization, and if required, declassification and/or removal of sensitive markings or information, will be accomplished prior to physical transfer to a DRMO. This code will be used for all ADEA items, including those which also require declassification and/or removal of sensitive marking or information. [When in doubt assign Demilitarization Code AG≅ for all recovered OE related scrap.]

5.2 Demilitarization Requirements

Demilitarization and decontamination of OE scrap is based on a system that assigns decontamination levels commensurate with the post treatment use. For metal that is being released to the public as recyclable, 5X is the acceptable degree of decontamination.

Past practices for recovery and certification of OE scrap from range maintenance contracts, BRAC and FUDS removal actions have improperly certified OE scrap as safe for turn-in to

DRMO for recycling based on inspection and certification by UXO/EOD technicians. In most cases this achieves a 3X level of decontamination by de facto. This is not sufficient for resale to the public. Three X=s indicate the equipment or facilities (in this case OE scrap) have been examined and decontaminated by approved procedures and no contamination can be detected by appropriate instrumentation, test solutions, or by visual inspections on easily accessible surfaces or in concealed housings, etc. and are considered safe for the intended use. Items decontaminated to this degree can not be furnished to qualified DOD or Industry users or subjected directly to open flame cutting, welding, high temperature heating devices), or operations which generate extreme heat, such as drilling and machining. Newly implemented certification procedures require two signatures for certification of which only one signature may be from a government contractor.

The only acceptable way to get to 5X decontamination is by partial or complete removal, neutralization, or destruction of explosives/explosive residue by flashing, steaming, neutralization, or other approved desensitizing methods such as shredding. This is often expensive and nullifies the value of the scrap. However to leave OE scrap on a range site increases the possibility of residues such as RDX, HBX, and TNT entering the ground water and causing a more expensive problem.

Technical instructions issued by the Defense Agency or Military Service having procurement responsibility for the item involved and/or instructions provided through the DOD demilitarization Bulletin Board System, will determine and identify the method of demilitarization and the degree to which additional demilitarization is necessary to meet the requirements in their respective areas. For additional information contact the following:

a) For ammunition procured by the Department of the Army, technical instructions relating to ballistic missiles, and large rockets, will be furnished by the Commander, U.S. Army Aviation and Missile Command (AMCOM), Attn: AMSAM-DSA-WO, Redstone Arsenal, AL 35898-5239

b) For conventional, chemical, and all other types of ammunition excluding lethal chemical agents and waste munitions, technical instructions will be provided by the U.S. Army Industrial Operations Command, Attn: AMSIO-SMK, Rock Island, IL 61299-6000

c) For lethal chemical agents including vesicants and nerve agents and their carriers, technical instructions will be furnished by the U.S. Army Armament Material Readiness Command Program Manager for the demilitarization of Chemical Material, Edgewood Arsenal, Aberdeen proving Ground, Maryland 21010

d) For ammunition procured by the Department of the Navy, technical instructions will be issued by the Commander, Naval Sea Systems Commander or by the Commander Naval Air Systems Command, department of the Navy, Washington, D.C.

e) For ammunition procured by the Department of the Air Force, technical instructions will be issued by the Engineering and Reliability Branch (MMWR), Ogden Air Logistics Center, Ogden, UT 84056-5609.

The following paragraphs provide guidance for the method and degree of required demilitarization for most types of OE items:

5.2.1 Category III. Ammunition - Method and Degree of Required Demilitarization

a) **Artillery/Mortar Ammunition Components and Similar Items of All Types** including but not limited to high explosive, practice, inert loaded, incendiary, and smoke fillers. Remove explosive filler from projectile (wash out, burn out, etc.). Remove rotating band and deform fuse cavity threads or score or deform bourrelet or gas check band. Burn propellant unless otherwise instructed to retain for sale or other purposes. Deform fin assembly threads or fin blades. Cartridge cases will be deformed by off-center punch-out of primer or split case neck or puncture the lower sidewall with a minimum of 3/4 inch hole or deform lower sidewall, which will prevent chambering, or crush or press. Burn out smoke mixture or detonate smoke canister.

b) **Inert Loaded Ammunition, Projectiles, and Similar Items of All Types** loaded with inert filler to simulate service item. Remove rotating band from artillery projectiles and open the closure of the projectile body to expose the inert filler. On items without rotating bands, open the body closure to expose the inert filler and damage the closure surface to prevent reloading or resealing.

NOTE: For inert loaded items (concrete, sand, plaster) a potential explosive safety hazard exists when the internal filler is not exposed or unconfined during burning. Melting, or cutting. Heat generated from a demilitarization process can cause the filler, moisture and air to expand and burst sealed casings. For this reason, DRMOs will not accept inert loaded items unless the internal filler is exposed and unconfined. The internal filler may be exposed by removal of the fuse well from the cavity, removal of base plates, or by puncturing/drilling holes I the bomb casing.

c) **Ammunition and Components Which Have Been Fired or Expended, Range Residue and Other Non-Explosive Items.** All items will be rendered free of energetic materials prior to accomplishment of demilitarization. Range residue will be processed in accordance with the defense Material Disposition Manual, DOD 4160.21-M, Chapter 4, paragraph B.3, after all required demilitarization is accomplished.

1. **Artillery/Mortar Ammunition Components and Similar Items of All Types.** Remove rotating band and deform fuse cavity threads or score or deform bourrelet or gas check band. Score practice round with a torch, displacing a minimum of one cubic inch of metal or shear into two pieces. Deform fin assembly threads and fin blades.

2. **Inert Loaded Ammunition, Projectiles, and Similar Items of All Types** loaded with inert filler to simulate service item. Remove rotating band from artillery projectiles and open the enclosure of the projectile body to expose the inert filler. On items without rotating bands, open the body closure to expose the inert filler and damage the closure surface to prevent relocating or resealing. **NOTE:** For inert loaded items (concrete, sand, plaster) a potential explosive safety hazard exists when the internal filler is not exposed or unconfined during burning, melting, or cutting. Heat generated from a demilitarization process can cause the filler, moisture and air to expand and burst sealed casings. For this reason, DRMOs will not accept inert loaded items unless the internal filler is exposed and unconfined. The internal filler

may be exposed by removal of the fuse well from the cavity, removal of base plates, or by puncturing/drilling holes I the bomb casing.

3. **Other Nonexplosive Filled Items** which perform a major function essential to the basic mission of the end item. Cut, crush, or process through a deactivation furnace. Burn or cut cartridge case lines and propelling charge bags. Cut, burn, or crush aircraft and ground signal cases. Crush or detonate piezoelectric (lucky) elements.

d) **Technical data** will be demilitarized by burning, shredding, or pulping.

5.2.2 Category V. Military Explosives, Solid and Liquid Propellants, Bombs, Mines, Incendiary Agents, and their Constituents - Method and Degree of Required Demilitarization

a) **Artillery/Mortar Ammunition Components and Similar Items of All Types** including but not limited to high explosive, practice, inert loaded, incendiary, and smoke fillers. Remove explosive filler from projectile (wash out, burn out, etc.). Remove rotating band and deform fuse cavity threads or score or deform bourrelet or gas check band. Burn propellant unless otherwise instructed to retain for sale or other purposes. Deform fin assembly threads or fin blades. Cartridge cases will be deformed by off-center punch-out of primer or split case neck or puncture the lower sidewall with a minimum of 3/4 inch hole or deform lower sidewall, which will prevent chambering, or crush or press. Burn out smoke mixture or detonate smoke canister.

b) **Inert Loaded Projectiles, Warheads and Similar Items of All Types** loaded with inert filler to simulate service item. Remove fuse and/or spotting charge, where applicable, and burn or detonate. Remove rotating band from artillery projectiles and open the enclosure of the projectile body to expose inert filler. On items without rotating bands, open the body closure to expose the inert filler and damage the closure surface to prevent reloading or resealing.

c) **Bombs and Similar Items of All Types,** including but not limited to high explosive, practice, inert loaded, incendiary and photo flash fillers, military explosive excavating devices, demolition blocks, and grenades. Demilitarization will be accomplished by removal of explosive filler in an approved manner (e.g., wash-out, burn-out, etc.) And by deforming fuse cavity threads or removing base plate by other than normal disassembly (such as sawing) or by detonation. Grenades will be demilitarized by cutting or crushing (a minimum of 75% compression) the grenade body after item has been defused and explosive removed or by detonation.

d) **Small Explosive Items**, including but not limited to fuses, boosters, primers, detonators, firing devices, ignition cartridges, blasting caps, grenade cartridges, tracer assemblies, and similar components. Demilitarization can be accomplished by processing through a deactivation furnace at settings of 1150 degrees at burner end and 450 to 500 degrees at stack end or by mutilation. Incendiary projectiles will normally be decored to expose and assist in the compete burning of the incendiary composition. Where decoring of projectile is not necessary, processing through the deactivation furnace is adequate. Burn out 20mm HE projectiles by processing through the deactivation furnace or detonate. Processing complete small arms ammunition cartridges, all caliber's, through the

deactivation furnace at controlled temperatures will result in adequate demilitarization. Fuses and boosters can be disposed of by disassembly and cutting, drilling, or punching to deform metal parts. Explosive components generated through disassembly are to be burned or detonated. Fuses may also be processed through a deactivation furnace as a complete item when disassembly is not feasible. For grenades demilitarization may be accomplished by removal of explosive components by crushing, cutting, breaking, melting, burning, or otherwise to fully preclude their rehabilitation or further use as grenade components. Demilitarization may also be accomplished by detonation or burning as appropriate for the particular item involved.

e) **Rocket Motors, Warheads, Components and Similar Items of All Types,** including high explosive, inert, loaded, practice and smoke. Wash out or burn out rocket warhead filler and mutilate casing by crushing or cutting by torch and deforming threaded area. Disassemble and remove or burn out rocket motor propellant and cut or crush case, and deform threaded area of cases. Rocket motors and warheads may also be detonated.

f) **Mines, Anti-Personnel/Anti-Tank Explosive, Components and Similar Items of All Types** including high explosive, practice, inert loaded associated explosive components. Wash out or burn out filler and mutilate by crushing, cutting by torch, deforming threaded area or detonate. Process mine fuses, activators, and firing devices through a deactivation furnace, burn in a cage or detonate. Mine firing such as the M56 or M61 types should be crushed, cut, or burned.

g) **Ammunition and Components Which Have Been Fired or Expended, Range Residue and Other Non-Explosive Items.** All items will be rendered free of energetic materials prior to accomplishment of demilitarization. Range residue will be processed in accordance with the defense Material Disposition Manual, DOD 4160.21-M, Chapter 4, paragraph B.3, after all required demilitarization is accomplished.

1. **Artillery/Mortar Ammunition Components and Similar Items of All Types** including but not limited to high explosive, practice, inert loaded, incendiary, and smoke fillers. Remove explosive filler from projectile (wash out, burn out, etc.). Remove rotating band and deform fuse cavity threads or score or deform bourrelet or gas check band. Score practice round with a torch, displacing a minimum of one cubic inch of metal or shear into two pieces. Deform fin assembly threads and fin blades. Defective cartridge cases will be deformed by off-center punch-out of primer or split case neck or puncture the lower sidewall with a minimum of ¾ inch hole or deform lower sidewall, which will prevent chambering, or crush or press. Burn out smoke mixture or detonate smoke canister.

2. **Inert Loaded Ammunition, Projectiles, and Similar Items of All Types** loaded with inert filler to simulate service item. Remove rotating band from artillery projectiles and open the enclosure of the projectile body to expose the inert filler. On items without rotating bands, open the body closure to expose the inert filler and damage the closure surface to prevent relocating or resealing. **NOTE:** For inert loaded items (concrete, sand, plaster) a potential explosive safety hazard exists when the internal filler is not exposed or unconfined during burning, melting, or cutting. Heat generated from a demilitarization process can cause the filler, moisture and air to

expand and burst sealed casings. For this reason, DRMOs will not accept inert loaded items unless the internal filler is exposed and unconfined. The internal filler may be exposed by removal of the fuse well from the cavity, removal of base plates, or by puncturing/drilling holes I the bomb casing.

3. **Bombs and Similar Items of All Types**, including but not limited to high explosive, practice, inert loaded, incendiary and photoflash fillers, military explosive excavating devices, demolition blocks and grenades. Demilitarization will be accomplished by deforming fuse cavity threads or removing base plate by other than normal disassembly (such as sawing) or by detonation. Grenades will be demilitarized by cutting or crushing (a minimum of 75% compression) the grenade body after item has been defused and explosive removed or by detonation.

4. **Rocket Motors, warheads, Components and Similar Items of All Types**, including high explosive, inert loaded, practice and smoke. Demilitarize casing by crushing or cutting by torch or deforming threaded area. Cut, crush case, or deform threaded area of rocket motor cases.

5. **Mines, Anti-Personnel/Anti-Tank, and Similar Items of All Types** including high explosive, practice, inert loaded and associated components. Demilitarize casing by crushing, or cutting by torch, and deforming threaded area or detonate. Mine firing devices such as the M56 or M61 types should be crushed, cut, or burned.

h) Instructions For Specific Ordnance Items:

1. BDU-50 Practice Bomb:

(a) Each bomb must be inspected by qualified EOD/UXO personnel to ensure that bombs are BDU-50s and that the bomb is expended. If the EOD/UXO personnel cannot verify both fuse wells, or absence thereof, it must be op-opened remotely by detonation.

(b) A 1/4 inch hole will be punched in each of the two spanner wrench receptacles, fracturing the metal to a depth in excess of 1/10 inch into the concrete filler material.

(c) A 1/4 inch punch will be utilized to further damage the threads of the nose plate, ensuring that the plate cannot be removed and replaced.

(d) Fins will be deformed or broken and paint will then be used to place a mark of contrasting color on the bomb or near the nose.

i) **Technical data** will be demilitarized by burning, shredding, or pulping.

5.2.3 Venting of OE-Related Scrap

Prior and current practices have taken this to mean that if the OE item is intact and resembles a piece of military ordnance, such as a 105mm HEAT (Practice) projectile, it should have a hole punched through the side to expose the filler as non-explosive. This is typically accomplished through the use of a shape charge attack. The explosively created hole exposes the filler and disfigures the projectile so that it could not be used again. For a 105 mm HEAT

(Practice) round this approach is sufficient because the projectile never contained any explosives or energetic material used as a spotting charge. For a MK- 82 LDGP Bomb (Practice) this approach may not be sufficient because the bomb can contain various types of explosively activated spotting charges that have the capability to cause injury or death if exposed to the right elements such as flame from a cutting torch. And their is always the possibility that a shape charge attack may punch a hole in an explosive ordnance item exposing the filler but not causing a detonation. Because some explosive fillers look like inert fillers the possibility for misidentification and improper certification is real.

UXO known or suspected to be inert (filled with an inert substance to simulate the weight of an explosive filler) will be explosively vented with conical-shaped charges. For the purpose of determining the fragmentation hazard area for explosive venting, it will be assumed that the UXO has an explosive filler and that a high-order detonation will occur. Venting will be considered successful when the inert filler is exposed. The vented inert ordnance item can be treated and disposed as scrap after the venting and demilitarization process is complete.

6.0 Certification/Disposal of Scrap Metal

The generating activity will ensure that the quantities of demilitarized property turned in to the DRMO are accurate and that these quantities are readily verifiable by the DRMO. DRMOs will not accept any property unless the DD Form 1348-1A contains the demilitarization code or clear text statement of the demilitarization required. An example of the DD Form 1348-1A is included as Form 2-5. The generating activity is responsible for issuing a letter specifying who is authorized to sign the statement of inert certification. This letter will be kept in the project files, at the local DRMO, and with the generating activity. It must be update as needed.

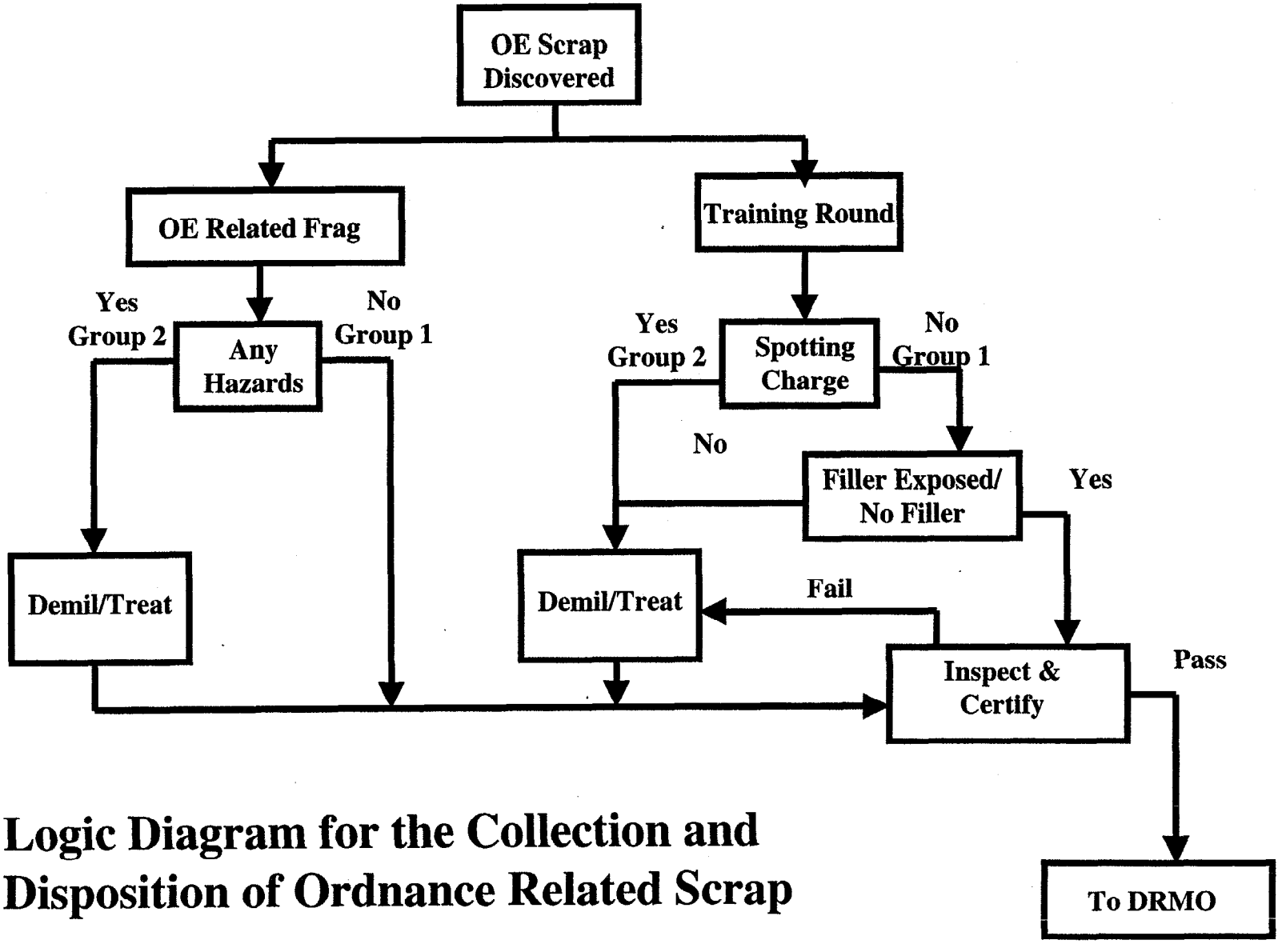
All material generated from the firing and/or demilitarization of AEDA will be rendered **free from explosives** before being referred to a DRMO for sale. All scrap metal, generated at the site, will be disposed of through the local DRMO or when appropriate and approved to a local scrap metal dealer, and will be transferred using DD Form 1348-1A. Prior to release of the material, the Senior UXO Supervisor will physically inspect the material in the containers to ensure that they are free of dangerous items or conduct demilitarization operations. The Senior UXO Supervisor will sign the certificate, typed on the DD Form 1348-1A, which states:

> "This certifies and verifies that the AEDA residue, Range Residue, and/or explosive contaminated property listed, has been 100 percent properly inspected, and to the best of our knowledge and belief, are inert and/or free of explosives or related materials."

The certification will be verified (countersigned) by a technically qualified U.S. government representative (U.S. citizen) designated by the responsible commander/generating activity.

Scrap will be segregated into like metals (mainly steel, aluminum, and mixed metal) and placed into palletized wooden shipping boxes. Each item placed into an inert-certified box will be inspected. The boxes will be filled, the covers will be nailed on, and a lead seal will be affixed. A Statement of Inert Certification will then be attached to the box. The box can then be picked up by a local scrap yard for disposal or recycling.

Using these procedures ensures that the collected scrap metal is properly inspected and classified. Our method includes three distinct inspections which are performed by persons of increasing levels of responsibility. The first inspection is performed at the operating grid by a qualified UXO Technician, the second is performed by the supervisor responsible for the operating grid, and the final inspection is performed by the Senior UXO Supervisor who is vested with overall responsibility.

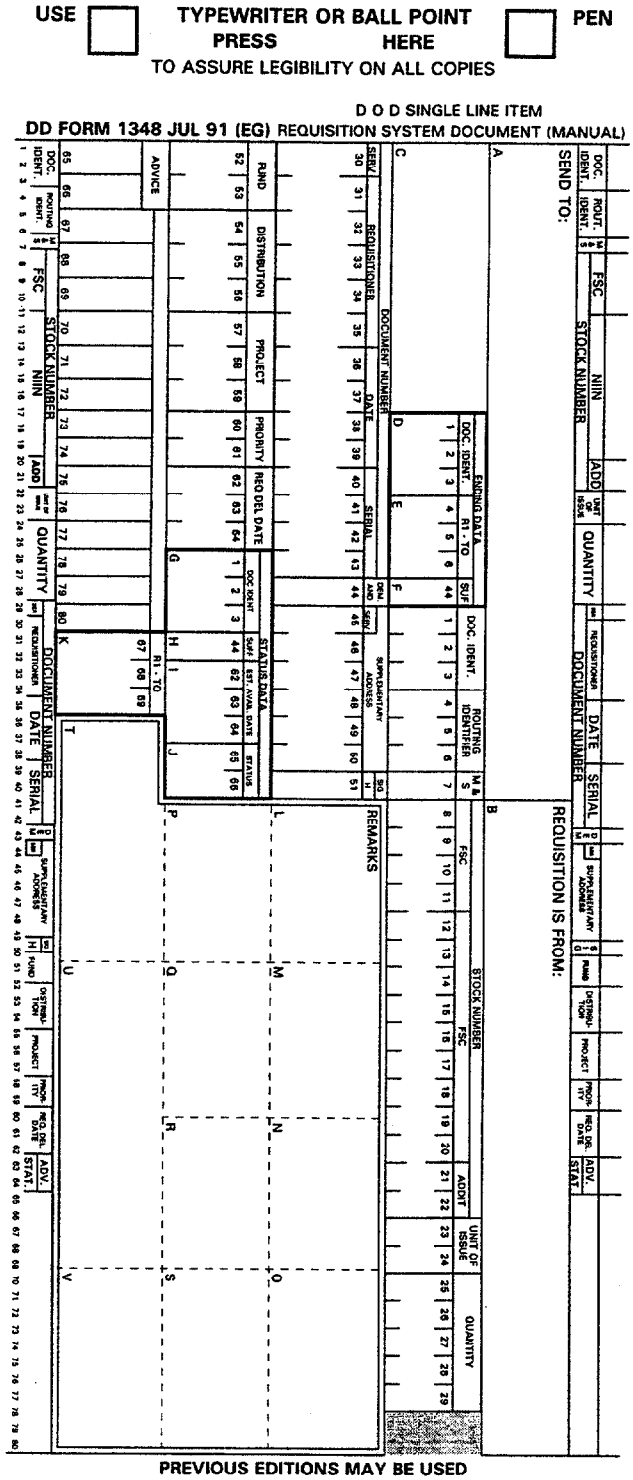


Logic Diagram for the Collection and Disposition of Ordnance Related Scrap

Figure 1

FORM 2-5

SCRAP CERTIFICATION FORM



APPENDIX B

Key UXO Personnel Résumés

Martin J. Clasen, P.G.

Project Manager

Education

M.S., Geology, University of South Florida
B.A., Geology, University of South Florida

Professional Registrations

Professional Geologist: Florida

Relevant Experience

Mr. Clasen is a project manager in the Environmental Business Group in CH2M HILL's Tampa office. As a professional geologist with more than 20 years of experience in the geosciences, Mr. Clasen has a wide range of expertise in various disciplines of geology including hydrogeology, deep well injection, ASR, groundwater supply wells, surface and borehole geophysics, groundwater modeling, environmental assessment, and remediation. Mr. Clasen has successfully managed projects for both public and private clients in various disciplines, including groundwater supply and environmental assessment and remediation.

Representative Projects

Mr. Clasen is currently the project manager of the Phase I RFI for 12 sites on the eastern end of Vieques Island, Puerto Rico. Additionally, he is project manager for an Expanded Preliminary Assessment/Site Investigation for 17 sites on the western end of Vieques Island.

Mr. Clasen successfully managed a $1.1 million dollar contamination assessment for the U.S. Navy in Puerto Rico. The project involves the environmental assessment of 15 underground storage tank sites including risk assessment and remedial design.

Mr. Clasen is the Project Hydrogeologist for the City of Tampa's Rome Avenue Park ASR Expansion site. He is responsible for coordinating permitting activities with the Florida Department of Environmental Protection and the Southwest Florida Water Management District. Mr. Clasen was responsible for preparing and presenting technical documents regarding groundwater modeling, well inventories, drilling and testing plans and mitigation plans. The objective of the project is to permit and install a 10 million gallon per day (mgd) ASR well field in an urban environment. The project offers unique challenges with a variety of stakeholders including the City of Tampa, regulatory agencies, and public groundwater users.

Mr. Clasen served as project manager for nine Site Investigations at Eglin Air Force Base in Florida. The project included coordination of sample collection and analysis, geophysical surveys, drilling, risk assessment, and report preparation.

Mr. Clasen is the project manager for a contamination assessment and remediation project at a metal manufacturing facility in Florida. The vertical extent of groundwater contamination was delineated in a highly fractured sinkhole-prone area. He conducted groundwater flow modeling to determine the effects of injecting treated water below the contaminant plume. The modeling supported the successful permitting of a Class V injection well. Capture zone modeling was also conducted to design a groundwater

recovery system in the center of the plume and a hydraulic barrier at the down gradient edge of the plume.

Mr. Clasen implemented a detailed contamination assessment plan at a battery recycling plant in Florida to determine the extent of lead contamination in the soils, surface water, stream sediments and groundwater. He conducted a time-series groundwater sampling test and hydrologic testing and soil and water sampling, analyzed the hydrologic and chemical data and prepared the Contamination Assessment Report.

Mr. Clasen was lead hydrogeologist for the DuPont Spruance Extraction System. He was responsible for installation and testing of 50 extracting wells and 25 performance monitoring wells. Supervised two hydrogeologists and three drilling crews.

As an independent geophysical contractor, Mr. Clasen conducted surface geophysical surveys to detect hydrocarbons, buried drums, hazardous waste, contaminant plumes, sinkholes, and fractures. He has experience with various geophysical techniques including ground penetrating radar, magnetometer, terrain conductivity, resistivity, spontaneous potential, gravity, and seismic refraction. Mr. Clasen possesses more than five years of drilling experience while employed as a geologist for two private minerals companies. Drilling methods included rotary, auger, reverse air, core, and sonic.

Mr. Clasen supervised the drilling, installation, and development of shallow and deep monitoring wells at MacDill Air Force Base, and was responsible for performing aquifer pumping tests and analyzing the test results. He also has conducted and supervised magnetometer, terrain conductivity, and ground penetrating radar surface geophysical surveys. Work included survey design, field collection of data, data reduction and interpretation, and final report preparation.

Mr. Clasen was lead hydrogeologist on a large data acquisition project at Robins Air Force Base with a very short time frame. All client-imposed deadlines were met. Tasks included developing drilling specifications for six deep, triple-cased monitoring wells, a Level B soil boring program, a shallow recovery well system, and a geophysical well logging program. The purpose of the deep monitoring wells was to determine if TCE had migrated down to a confining unit. Mr. Clasen supervised five drilling crews, conducted aquifer tests and geophysical logging, and prepared technical reports on the deep monitoring well construction and geophysical logging.

Mr. Clasen was project manager for the drilling and testing of four wells in the Northwest Hillsborough Water Resources Assessment Project for the Southwest Florida Water Management District. The project objectives were to determine the hydrogeologic properties of the Upper Floridan Aquifer, the depth of the saltwater interface, and the safe yield of the Upper Floridan Aquifer through a detailed hydrogeologic testing program that included geologic logging, large diameter coring, geophysical logging, water quality sampling, pumping tests, and packer tests. Mr. Clasen analyzed the data and prepared the final hydrogeologic report.

Martin J. Clasen

Mr. Clasen supervised a 72-hour aquifer pumping test of the reverse osmosis well field for the Englewood Water District in Florida. Responsible for completing an engineering report for the modification of a consumptive use permit. The report included aquifer test analysis, groundwater flow modeling, and geochemical data interpretation.

Mr. Clasen conducted detailed three-dimensional groundwater flow modeling to evaluate mounding effects from 85 rapid infiltration basins. He also calibrated the model with existing data and ran predictive models to support an increase on permitted infiltration rates.

Membership in Professional Organization

Association of Groundwater Scientists and Engineers (NWWA)
Ground Water Protection Council

Fernando Ferreira, C.P.G.

Geologist

Education

A.S., Civil Engineering Technician, Wentworth Institute of Technology
B.S., Geology/Earth Sciences, University of Massachusetts
MBA, Business Administration, University of Tampa

Professional Registration

Certified Professional Geologist: National Certification #9607

Related Experience

Hazardous Waste Site Investigations: RCRA, CERCLA
Underground Storage Tank Management
Utility System Evaluations
Water Resource Evaluation and Delineation
Environmental Site Assessments
Waste Minimization Programs
Due Diligence
Total Quality Management: ISO 9000 trained
Global Marketing and Business Research
Organizational Analysis

Representative Projects

U.S. Navy-Atlantic Division (LANTDIV). Mr. Ferreira has been an integral team member on numerous projects for LANTDIV, specifically at Vieques Island, Puerto Rico. In his role as an Assistant Project Manager in Vieques, Mr. Ferreira is responsible for the development and implementation of work plans across a broad spectrum of investigations, including OE/UXO.

Mr. Ferreira has also managed numerous projects at Naval Station Roosevelt Roads (NSSR) under the underground storage tank (UST) program.

Air Force Center for Environmental Excellence (AFCEE). Mr. Ferreira has completed numerous phased environmental projects for AFCEE on installations from Maine to Florida. These projects include initial site investigations to site characterization through site remediation and restoration. Mr. Ferreira has served as both field operations manager and project manager on several projects, most notably at Westover Air Force Base in western Massachusetts. Most recently, Mr. Ferreira has been supporting efforts at Cape Canaveral Air Station (CCAS) and Patrick Air Force Base (PAFB) in east-central Florida, including a soil remediation project at PAFB and a RCRA Facility Investigation (RFI) at the Malabar Annex.

Sullivan's Ledge Superfund Site, New Bedford MA. Mr. Ferreira served as the field operations manager for the remedial investigation/feasibility study (RI/FS) study at this former rock quarry. In this role, Mr. Ferreira was responsible for the design and implementation of the RI/FS and was also responsible for evaluation of remedial alternatives. Mr. Ferreira was also involved in the preliminary design of the landfill

cap/groundwater treatment system that was chosen as the remedial option. Mr. Ferreira also served as the principal liasion between the design group and the potentially responsible party (PRP) team on this superfund site.

Providence Water Supply Board, Lincoln, Rhode Island. Mr. Ferreira served as a project scientist in this Facility Needs Assessment conducted as part of a proposed water treatment plant facility upgrade. In this role, Mr. Ferreira was responsible for collection of initial site data on the early 1920's Lincoln, RI plant that serviced Providence, as well as other municipalities. Mr. Ferreira was also tasked with evaluating the physical and structural condition of existing structures including buildings, dams, metering chambers, junction chambers, coagulation basins, chemical feed silos, power transmission lines, abandoned hydro-electric plant, and for reviewing process instrumentation and diagrams.

U.S. Navy Southern Division (SOUTHDIV). Mr. Ferreira served as the operations manager on numerous facilities at the former Naval Training Center (NTC) in Orlando, FL. In his support role for CCI, Mr. Ferreira was responsible for the successful completion of investigatory and remedial actions under CCI's remediation and construction (RAC) contract. Remediation work included a pump and treat retrofit and enhanced in-situ oxidation program.

Mobil Oil Corporation, Marshfield, MA. Mr. Ferreira performed several Phase I through Phase V environmental projects under the Massachusetts Contingency Plan (MCP) throughout the Commonwealth of Massachusetts. For these projects, Mr. Ferreira served as field engineer/scientist implementing work plans through project development and design as a project and senior project scientist.

Florida National Guard Bureau. Mr. Ferreira was Task Manager for a site investigation (SI) at the combined support maintenance shop (CSMS) at Camp Blanding in Starke, Florida. In this role, Mr. Ferreira designed and implemented the SI field program, evaluated site data, and prepared the final SI Report.

Columbia Manufacturing, Westfield MA. Mr. Ferreira served as project manager for a RCRA Facility Investigation (RFI) under a federal consent decree for site corrective actions. During implementation of Phase II RFI, Mr. Ferreira was instrumental in developing, designing, and implementing several interim measures (IM) at the site which assisted client in meeting several corrective actions required by the consent decree. Mr. Ferreira's relationship with the USEPA officials help keep accelerated project on track and under budget.

Naval Facilities Northern Division, Philadelphia, PA. Mr. Ferreira was responsible for the design and implementation of a sewer system evaluation survey (SSES) at the Naval Education Training Center in Newport, Rhode Island. This project was designed to identify sewer system inefficiencies for subsequent utility upgrades. Mr. Ferreira assisted senior engineers with rehabilitation design of existing 48-mile sewer system following evaluation phases.

Burgess Brothers Superfund Site, Bennington VT. In his role as a project scientist, Mr. Ferreira was responsible for the design and implementation of a RI/FS at this former Eveready Battery dumping site in Bennington, VT. Mr. Ferreira was also responsible for developing the draft RI/FS report and in overall project management.

General Motors, Leon, Mexico. Mr. Ferreira was responsible for Phase I/II site investigation as part of due diligence property transfer to Motorola. Mr. Ferreira designed and implemented the program in a fast track method to assist client in meeting schedule commitments with Motorola.

Ecologia Y Empresa, La Paz Bolivia. In his role as a subcontractor to a local Bolivian engineering firm, Mr. Ferreira was responsible for theoretical and practical field training on Phase I site assessments. In addition, Mr. Ferreira was also responsible for technical consultation with client in Bolivia and with the development of a Access Database designed to prioritize sites for potential Phase II comprehensive site assessments.

Boston Housing Authority, Boston, MA. Mr. Ferreira was responsible for the development of a underground storage tank (UST) inventory program that included 71 individual developments throughout Boston City proper. This program was developed as a tool to identify UST's that would not meet the December 22, 1998 date for mandatory UST upgrades on tanks greater than 10 years old. Mr. Ferreira trained co-operative Boston Housing staff in site data collection efforts and other BHA staff on design of maintenance of the UST database.

Other Relevant Experience

Project Management Training
Total Quality Management Training for ISO 9000 certification
40 Hr OSHA training
8 Hr NRC training: Radiological Site Safety and Operations
24 Hr training: Asbestos building inspector
International business development training
Oral and written skills in Portuguese and Spanish

Membership in Professional Organizations

American Institute of Professional Geologists

Erik Isern, E.I.T.

Environmental Engineer

Education

B.S., Mathematics, Interamerican University, Cupey, PR
B.S.C.E., Polytechnic University, Hato Rey, PR
Graduate Studies, University of Michigan, Ann Arbor, MI

Professional Registrations

Engineer-in-Training

Project Experience

As an environmental engineer for CH 2M HILL, Erik is the field team leader for the site investigation activities in the Vieques projects. He is responsible for coordinating the field sampling events and is also the site safety coordinator. He provides support for Respriation Tests at Site SS-36 in Eglin AFB, Florida, and Site 124, Hurlburt Field, Florida. Sampled respiration points with air pumps to collect data for performance evaluations of the bioventing systems for both sites. Erik has been the Field Superintendent for the UXO/OE investigations within NASD, Vieques, Puerto Rico including the Green Beach/Western Maneuver Area.

As environmental engineer with the CSA Group, San Juan, PR, in the Aquatic and Terrestrial Ecology Department, Erik's role was to provide support in the area of field data gathering, data analysis, and report writing as well as technical expertise from an engineering point of view. He coordinated environmental sampling of rivers and estuaries with environmental laboratories and prepared monthly and semiannual reports from those events as part of the water intake permits required by the EPA for the Puerto Rico Aqueduct and Sewer Authority. Erik was selected as team leader for sampling regional wastewater treatment plants as part of the 301 (h) Section of the Clean Water Act Waiver Demonstration for primary treatment plants discharging into the ocean via dispersion outfalls. As team leader, he was responsible for the WWTP sampling event including coordination with the plant supervisors, procurement of the equipment and manpower necessary to perform the sampling, and supervise the QA/QC of the sampling itself to assure that the procedures are carried out as established in the work plan. He also provided support in the packaging and handling of the samples that are shipped to various environmental laboratories.

As environmental engineer with CSA's Hydraulic and Hydrology Department, Erik became involved with H/H modeling of such projects as residential housing developments and watersheds. He was responsible for the verification of the computer-based models, Visual HEC, HEC-RAS, Pond Pack, etc., as applied to an area in both its undeveloped and developed stages. He also performed an analysis to specify whether retention or detention ponds were needed for runoff management within the development or project.

Other projects he was involved with were Rio Grande de Arecibo Watershed Management Plan, Lago Lucchetti Sanitary Survey, and groundwater well monitoring and sampling.

As a project engineer for Warner Lambert, Inc., in Fajardo, PR, Erik was responsible for managing, coordinating, and motivating people to maintain high standards in project

execution. He organized available people and methods to permit routine matters to proceed with minimum effort and delay while responding quickly and effectively to unusual or emergency needs. He directed all aspects of project execution required by the project scope including engineering, design, procurement, construction and facility start-up, and played a lead role in the proposal stage, served as the company's technical representative in contract negotiation, and in executing the projects as specified on time and within budget.

Erik was hired as a self-employed contractor for overseeing and supervising the demolition and decommissioning of hormone replacement treatment (HRT) contract manufacturing facilities in Humacao, PR, for a period of five weeks. Because of his good ethics and diligent work, his contract was extended for the duration and was transferred to the Fajardo WL manufacturing plant. Projects supervised ranged from small ($20K) to medium ($400K) and included the placement of sluice gates to regulate stormwater runoff as specified in the plant's spill prevention plan, cafeteria remodeling, and computer center remodeling.

For the National Center for Integrated Bioremediation Research and Development in Oscoda, MI, Erik worked as a research assistant. As part of a select group of graduate students from the University of Michigan's Environmental Engineering Department, he was involved with the characterization of a shallow, unconfined aquifer at Wurtsmith AFB, National Superfund Site. His responsibilities included sampling and analyzing PCE- and TCE-contaminated groundwater from monitoring wells using state-of-the-art methods and equipment. Some of these methods were being developed onsite as part of the technology development program. He formed part of the team dedicated to establishing SOPs for the field equipment used such as field GCs, PID, FID, ion probe, and fluorometer. These SOPs would serve as field guides for use by future university personnel and technicians. Because of his civil engineering background, he was chosen to provide a topographic representation of the field site that included level measurements of the grid work where underground bioremediation test lanes were laid out.

Erik worked as Civil/Environmental Engineer for CMA Architects & Engineers, San Juan, PR. He was responsible for environmental permitting of construction projects, building use, and air quality permits. He was a key player in the coordination with the Environmental Quality Board, Planning Board, and U.S. Corps of Engineers. He assisted in preparing environmental assessments and environmental impact statements. He supervised a team of 10 college summer interns. He coordinated the Statewide Transportation Study with PRHTA and DTPW in accordance with ISTEA requirements for municipal and state governments.

Erik worked as a public assistance engineer for the Office of the Governor's Authorized Representative for FEMA, San Juan, Puerto Rico. He was responsible for performing final inspections and field reports of Federal-aid disaster projects in preparation for their closure as per FEMA guidelines. He routinely inspected highways and bridges after reconstruction and certified them for completeness. He served as liaison between local, state, and Federal governments. He provided technical assistance to the local governments agencies and organizations.

Erik Isern

As a public assistance engineer for the Federal Emergency Management Agency in San Juan, PR, Erik was responsible for damage assessments and providing field reports of Nationally declared disasters including the Three King's Flood in 1992 (PR) and older disasters in PR, USVI, and others within the FEMA Region II jurisdiction. He performed damage assessment of infrastructure projects including highways, bridges, culverts, retaining walls, and pipe systems. He provided cost estimates for restoration to pre-disaster conditions of public buildings, bridges, and roads. He was also involved in training county and local government emergency-management employees in all aspects of FEMA participation. Topics covered in the training sessions were eligibility, classification of small and large projects, and closure of projects and applicants.

He was Mathematics Professor at the Polytechnic University of Puerto Rico, Hato Rey, PR. He was responsible for preparing and teaching college-level mathematics courses to entering freshmen. These courses included elementary algebra, trigonometry, and pre-calculus. Workload per trimester was four sections of about thirty students per class. He had to structure the course according to departmental guidelines, prepare and correct exams.

For GEO CIM, Inc., in San Juan, Puerto Rico, Erik was responsible for conducting sieve analyses, penetrometer tests, Atterberg limits, and concrete strength testing. He visited projects to pick up concrete samples and also monitored wells near fuel tanks in gas stations for detection of possible leaks.

George R. Overby

OE Program Manager/Risk Analyst

Education

M.S. Studies, Environmental Systems Engineering, Clemson University
B.S., Marine Biology, University of South Carolina

Professional Registrations

Certified Hazardous Materials Manager: Institute of Hazardous Materials Management (No. 5965, 1995)

Distinguishing Qualifications

- Naval EOD trained UXO Technician
- Extensive investigative and removal experience involving unique military contaminants such as UXO, radioactive materials, and chemical warfare agents
- Extensive knowledge of RCRA, CERCLA, and USACE regulations and requirements

Relevant Experience

Mr. Overby is a Certified Hazardous Materials Manager (CHMM) with over 17 years of experience in managing environmental concerns ranging from Petroleum Hydrocarbon contamination to Unexploded Ordnance (UXO) and Chemical Warfare Material (CWM). His relevant experience is provided below.

UNEXPLODED ORDNANCE SURVEY/REMOVAL

- **Project Manager/UXO Survey and Removal/Loring AFB, Caribou, ME.** Responsible for a multi-site UXO detection and removal effort at the former Loring AFB. The effort involved site/item combinations such as overgrown 40mm ranges, military reconnaissance training areas contaminated with small arms rounds and training devices, as well as aircraft delivered bombing ranges. Many of the areas presented unique challenges due to the condition of physical setting of the site. The challenges included 40mm ranges in delineated wetlands, training site in heavily forested areas, and bombing areas in a cranberry bog as well as several sites that also contained environmental concerns. Managed all aspects of the project to include designing the survey methods, all interactions with military and U.S. Army Corps personnel, and report preparation.
- **Project Manager/UXO Survey and Removal/Former Camp Bonneville, Vancouver, WA.** Responsible for the design and execution of detection surveys and removal efforts for grenade and artillery ranges at the former U.S. Army Training Center. Project sites required geophysical surveys to be conducted in rough mountainous terrain. Due to the extensive acreage a statistically significant number of survey plots were selected and evaluated using electro-magnetic conductance detection methods. Successfully completed all aspects of the project while minimizing intrusive exploration due to the installations interest in habitat preservation.

- **Project Manager/UXO Survey and Removal/Jefferson Proving Grounds, Madison, IN.** Designed and implemented detection and removal efforts at several sites within JPG, all of which involved significant acreage and a variety of ordnance due to the R&D mission of the proving ground. Employed a surface-towed Electro-magnetic (EM) conductance survey integrated with global positioning system information. Project involved in the production of EM contoured detection maps that were employed to increase productivity during the removal phase. Responsible for client, Corps, and landowner interactions, and production of all project documents.

- **Project Manager/Remedial Action/Columbia Metropolitan Airport, Columbia, SC.** Managed a significant remedial action effort at the Airport's Aviation Fuel Tank Farm. Designed the effort to remove only the soil contaminated with petroleum hydrocarbons at levels above acceptable regulatory standards. Employed field-screening techniques such as immunoassay/colorimetric testing to confirm points where soil removal could stop and confirmation samples could be taken. Screening efforts coupled with on-site thermal treatment resulted in a rapid site cleanup and a reduced cost. Coordinated all site activities with State Environmental Managers to insure acceptability to methods and cost in accordance with State UST Reimbursement Program.

REMEDIAL DESIGN/REMOVAL ACTION

- **Project Manager/Remedial Design, System Startup and O&M/Milan AAP, Milan, TN.** Managed tasks including the detail design for several systems associated with a 1.2MGD ground water treatment plant. Coordinated the construction and land survey and provided the oversight during the preparation of all startup and O&M documents. Conducted the startup, evaluation, and operation & maintenance for the treatment facility.

- **Project Manager/Remedial Design/Build, Redstone Arsenal, AL.** Responsible for the design of a storage tank, pump station, and force main associated with the ground water recovery and treatment system at Operable Unit 10. Managed all facets of the design process to include drawing and specification preparation, design review meetings, and interaction with the Client, Arsenal Representatives and the U.S. Army Corps of Engineers.

- **Project Manager/Removal Action/Ogden Depot, UT.** Designed a removal action for acutely toxic and hazardous material at the former Ogden Depot. Responsibilities included evaluation of best available removal technologies, removal event coordination, and confirmation of process effectiveness. Project also included the preparation of community action plans and spill prevention control and countermeasure plans.

REMEDIAL INVESTIGATION/FEASIBILITY STUDY

- **Program Manager/Site Inspections, Remedial Investigation/Redstone Arsenal, Huntsville, Alabama.** Conducted site inspections and remedial investigations at 55 sites located on both the Arsenal property and Marshall Space Flight Center. The work was

conducted for the Arsenal's Installation Restoration Program through a contract with the Savannah District U.S. Army Corps. The sites ranged in complexity from those suspected of petroleum and solvent contamination in the soil and groundwater to sites potentially contaminated with chemical warfare material and explosives. Responsible for all aspects of the projects to include the proposal and negotiation phase, the work plan and overall field effort, the data evaluation and report preparation, as well as all interaction with the Alabama Department of Environmental Management, Region IV EPA, Redstone Arsenal, and the U.S. Army Corps of Engineers.

- **Project Manager/Remedial Investigation/Hamilton AFB, Novato, CA.** Responsible for structuring and implementing a program to delineate petroleum and metals contamination around the former Hamilton AFB Airfield. Managed the preparation of all documents, interactions with the U.S. Air Force and Army Corps of Engineers, and the activities and schedules of all subconsultants/subcontractors. Investigation resulted in a removal action for the petroleum-contaminated area and capping the area determined to be contaminated with metals and instituting a long-term monitoring program.

- **Project Manager/Remedial Investigation/Norton AFB, San Bernardino, CA.** Managed a large-scale ground water investigation in conjunction with U.S. EPA, the U.S. Air Force, and the U.S. Army Corps of Engineers. Effort included the installation of monitoring wells in the vicinity of a suspected low-level radioactive waste burial site and the subsequent sampling of the ground water. Initial sampling activities resulted in expanding the project to off-site locations and involvement by the local Water Treatment Department due to concern over a possible impact to drinking water supply wells. Responsibilities included all verbal and written correspondence with the involved parties and preparing the project recommendation documents.

REMEDIAL SYSTEM/VALUE ENGINEERING

- **Project Manager/Value Engineering System Startup/Tyndall AFB, FL.** Responsible for the evaluation and subsequent recommendations for improvement of a free product recovery system. Evaluation recommendation resulted in significant savings for the U.S. Air Force by employing a system to separate and remove petroleum hydrocarbons from the surficial aquifer under the former Tyndall AFB POL Facility. Additional benefits from the Value Engineering included reduced site remediation time and positive public relations for the installation.

- **Project Manager/Value Engineering, Treatment System Evaluation/GE Gas Turbine Plant, Greenville, SC.** Conducted the performance analysis of a remedial system designed and installed to strip volatile organic contaminants from the surface water in a stream adjacent to the facility. Effort involved collecting numerous surface water samples, conducting a water balance for the stream where it bordered the plant, and performing dye trace analysis to determine the retention time of the treatment system.

Other task included representing the client during regulatory reviews and public meetings.

- **Project Scientist/Value Engineering, Remedial System Evaluation/Chemtronics NPL Site, Swannanoa, NC.** Responsibilities included the trend analysis associated with the ground water treatment system conducted to determine effectiveness and insure compliance with the operating permit. Other responsibilities involved the rehabilitation and O&M of the wells associated with the ground water infiltration system, client representation during project reviews and public meetings, and system expansion evaluations.

ENVIRONMENTAL SITE ASSESSMENT/BASELINE STUDY

- **Project Manager/Environmental Baseline Study/Proposed FBI Training Center, RSA, AL.** Responsible for the completion of an EBS at the proposed location of a training center for the Federal Bureau of Investigation. The study was completed in accordance with Army Regulation 200-1, Environmental Protection and Enhancement, and ASTM E 1527-94, Standard Practice for Environmental Assessments. The effort was modified to include screening level sampling and analysis of the soil and groundwater at the site as well as lead and asbestos sampling of the structures on the property. Managed all aspects of the report preparation and review.

- **Project Manager/Environmental Site Assessment/City of Owensboro, Owensboro, KY.** Managed all aspects of a Phase II assessment completed to address the environmental concerns identified in a previous Phase I Assessment. Activities included employing direct-push technology to assess areas of concern that resulted from a former road sign painting operation, a group of UST's used for fleet maintenance, and previous landfill operations. Responsible for all aspects of the project to include subcontractor coordination, client interactions, and data interpretation and reporting.

- **Project Manager/Environmental Site Assessment/City of Huntsville, Huntsville, AL.** Managed all aspects of a Phase I assessment completed to satisfy the requirements associated with roadway expansion. Activities included archive environmental database search, evaluation of aerial photographs and topographic maps, knowledgeable party interviews, and a site visit. Responsible for all aspects of the project to include subcontractor coordination, client interactions, and data interpretation and reporting.

PRELIMINARY ASSESMENT/SITE INVESTIGATION

- **Project Manager/Site Investigation/Tyndall AFB, Panama City, FL.** Responsible for designing and conducting a site investigation assessment of Shoal Point Bayou located at Tyndall AFB. Task included evaluating the potential impact to the sites ground water, surface water, soil, and sediment as well as identifying all flora and fauna that were subject to impact due to potentially complete exposure pathway. The contaminants of concern were petroleum, metals, and pesticides. Worked with State and Federal Fish and Wildlife Agencies to coordinate the collection of all species needed for assessment.

Conducted all necessary regulatory interaction and document production and prepared the recommendations for additional site investigation work.

- **Project Manager/Site Investigation/Tri-County Landfill, Brooks, KY.** Completed the design and execution of a site investigation following a U.S. EPA emergency response to remove 55-gallon drums of spent solvents discovered in close proximity to a local community. The investigation involved collecting representative samples of ground water, soil, sediment, air, and surface water. In addition surface water from an adjacent stream was used for chronic toxicity testing. Responsible for all interactions with U.S. EPA, their oversight contractor, as well as the consulting and legal representatives for the PRP group.

- **Project Manager/Preliminary Assessment/Brewer Gold Mine, Lancaster, SC.** Completed the design and execution of a preliminary assessment as part of a U.S. EPA emergency response following the failure of a leaching solution retention basin. Responsible for all aspects of the initial assessment to include soil and sediment sampling with the U.S. EPA oversight contractor. Evaluation and volume determination of transported, potentially hazardous, material that was entrained with the released liquid and deposited within the adjacent ravine. Additional areas of involvement included assessing the fish kill resulting from the release that flowed into the adjacent creek and coordination with facility personnel, State environmental personnel, and U.S. EPA oversight contractor.

COMPLIANCE

- **Program Manager/Site Assessment/Loring AFB, Caribou, ME.** Responsible for the wetland evaluation and delineation for multiple sites at the former Loring AFB. Interacted with regulatory agencies, the installation, and the U.S. Army Corps to determine acceptable practices for the removal of unexploded ordnance contamination from wetland areas. Subsequently responsible for the permitting associated with the removal actions conducted in sensitive wetland areas.

- **Project Manager/RCRA Site Closure/Tyndall AFB, Panama City, FL.** Responsible for all tasks associated with the site closure process at a former construction debris landfill. Provided oversight during the production of the Closure Permit Application and managed all pre-closure sampling activities. Conducted all necessary meetings with the U.S. Army Corps and the State Regulatory Agencies. Successfully completed all closure requirements and delivered the site into post closure annual monitoring.

- **Project Manager/RCRA Site Closure Permit and Closure Action/Sew Simple Systems, Greenville, SC.** Responsible for the unit closure in accordance with RCRA guidelines. Activities included the completion of the permit application, designing and implementing a pre-closure sampling and analysis plan, and conducting all post-closure sampling and reporting requirements. Additional task involved client representation during regulatory review meetings and Public RCRA Closure Meetings.

George R. Overby

OTHER EXPERIENCE

- **Project Manager/Various UST Closures/NC, SC, GA, FL, TN, and AL.** Responsible for all aspects of numerous UST closures conducted throughout the southeastern U.S. Specifically, provided the coordination of all site subcontractors, ensured compliance with all health and safety requirements were met, conducted or provided oversight for all associated sampling efforts, evaluated all site history, hydrogeologic characteristics, and project generated data, and prepared closure reports suitable for submission to the various regulatory agencies.

Highlights of Mr. Overby's experience prior to joining CH2M HILL include the following.

Director Ordnance and Environmental Programs
QuantiTech, Inc.
March 2000 – April 2001

Mr. Overby's responsibilities included the design, implementation, and management of methods to assess the completeness, effectiveness, and residual risk associated with the characterization and cleanup of Unexploded Ordnance (UXO). In addition, he was charged with the development, oversight, and performance for the application of QuantiTech methods and products within the environmental industry. His specific responsibilities included the daily oversight of UXO and environmental projects, management of technical staff, and market and client development.

Environmental Department Manager
PDR Engineers, Inc.
Feb 1998 – Mar 2000

Mr. Overby was charged with the development of the company's environmental capability, the marketing of that capability, and the management of the environmental staff. He was involved in all aspects of PDR's responsibilities as a team member on the South Atlantic Division Total Environmental Restoration Contract with the U.S. Army Corps of Engineers (USACE) as well as providing environmental services to other departments within the company. He served in a managerial or oversight role on projects ranging from Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) - regulated investigations to environmental information management services using Global Positioning Systems (GPS) and Geographical Information Systems (GIS) to support in the design, operation and maintenance of groundwater extraction and treatment systems.

Vice President, Federal Programs
UXB International, Inc.
July 1997 – February 1998

Mr. Overby's responsibilities included planning, coordinating, and overseeing the project activities of fifteen project managers conducting work on Engineering Evaluation/Cost Analysis and/or UXO Removal efforts in association with an USACE Huntsville Contract.

He reported directly to the President of UXB on all phases of Federal Contract Services performed by the company. Mr. Overby supervised all aspects of the Huntsville office operations to include contract development with the Huntsville USACE and daily office operations.

Senior Project Manager
Rust Environment & Infrastructure
December 1989 – July 1997

Mr. Overby's responsibilities included serving as senior project manager during the design, implementation, and performance of site remedial investigations, baseline risk assessments, and feasibility studies in accordance with Resource Conservation and Recovery Act (RCRA), CERCLA, and USACE requirements. He was charged with insuring the performance, effectiveness, and quality of all project-related issues to include regulatory communications, partnering meetings, agency reports, RCRA closure permit applications, and project related waste disposal applications. Mr. Overby managed this role on sites ranging in complexity from routine sample collection activities involving solvents and petroleum to extensive investigative and removal efforts involving unique military contaminants such as UXO, radioactive materials, and chemical warfare agents.

Explosive Ordnance Disposal Diver
United States Navy
October 1983 – October 1989

Mr. Overby facilitated the technical transport of explosive and hazardous agents, and supervised and conducted extensive surface and underwater explosive and hazardous agent operations. His specific assignments included the supervision of equipment and material readiness activities, preparation and administration of training programs, management of diving operations, and support to the United States Secret Service.

Professional Societies

The Society of American Military Engineers, No. E783160, 1996

Specialized Training

UXO Specialist, Naval Explosive Ordnance Disposal (EOD) School, Indian Head, MD (1986)

Professional Licenses

Certified Hazardous Materials Manager: Institute of Hazardous Materials Management (No. 5965, 1995)

Ben Redmond

Global Practice Leader

Education

B.A., Human Resource Management, Pepperdine University
A.A., General Education, Marine Associate Degree Completion Program. Pensacola Jr. Coll.

Registrations/Certifications

Master EOD Technician 1980
Master Training Specialist 1981
Senior UXO Supervisor 1990
Top Secret Clearance, Department of Defense, U.S. Marine Corps 1974-1990
Secret Clearance, Department of Defense Contractor 1991-1994

Professional Affiliations

International Society of Explosive Engineers
Society of American Military Engineers
International Association of Bomb Technicians and Investigators

Distinguishing Qualifications

Mr. Redmond is the Global Practice Leader for Ordnance Explosives responsible for management of all of the functional disciplines needed to perform OE/UXO/CWM. Demining operations from cradle to grave using a systems engineered approach. He is a graduate of Pepperdine University. As a program manager with ten years civilian experience and as a retired Marine Officer with over 22 years of Ammunition and EOD experience, he was one of the co-founders of The EOD Technology Group and served in virtually every position within that corporate structure.

His experience includes serving as a field UXO Technician, Site Safety Officer, Site Supervisor, Disassembly Technician, Project Manager, Program Manager, Program Engineer and Project Engineer, as well as developing proposals and conducting business management of the organization. He was also one of the co-founders of the National Association of Ordnance Explosive Waste Contractors (NAOC) and served as the inaugural Vice President and Vice Chairman of the Board. He has served as the Vice President of two different corporations and as Program Manager for EOD/UXO/OE Characterization, Remediation, and Demilitarization. He has served as Vice President of two different corporations and as Program for EOD/OE/OE Characterization, Remediation and Demilitarization. He currently serves as the Director of the UXO Service Center and Co-Chairman of the UXO Technology Review Board. In addition he serves as a Senior Military Advisor to the Oak Ridge National Laboratory where he serves on the DOE Intra-laboratory UXO/Mine Detection Task Force and is chairman of the UXO Focus Working Group. Mr. Redmond is also serving on the Strategic Management Analysis Requirement and Technology (SMART) Team for development of UXO clearance standards within the Department of the Army and on the U.S. Navy UXO Tiger Team for review of OE/UXO policy and performance.

His military experience includes service as the Officer in Charge (OIC) of various size EOD Units, from special operations 3-man teams to 78-person EOD Platoons, and a 160-person

Range Control Unit. Mr. Redmond was been the Project Officer for special projects, such as establishing the Advanced Access and Disablement of Improvised Nuclear Devices (AAD/IND) Division of the Naval EOD School, Indian Head, Maryland; Range Clearance and Refurbishment Projects ranging from 1-day projects to 2-year projects; projects for the demilitarization, disassembly and inerting of unknown foreign ordnance; operations to recover and exploit unknown foreign ordnance; and projects for development of specialized tools and equipment. Mr. Redmond is designated as a Master Training Specialist, with experience as an instructor in the military and at the college level. His expertise as an instructor is noteworthy in that he has been requested by name for DoD Mobile Training Teams in EOD related areas and counter terrorism. He has been an instructor for the State Department Anti-Terrorist Assistance Program (ATAP), responsible for training foreign nationals in EOD related areas.

Project Experience

As the Global Practice Leader for Ordnance Explosives (OE) within CH2M Hill, Mr. Redmond serves as the Team Leader and is responsible for developing business strategies and management of an emerging business in the OE market. Mr. Redmond is responsible for providing resources to Program and Project Managers where UXO is an ancillary contaminate or to assist in evaluating requirements for UXO support. For UXO contracts Mr. Redmond serves as the Program Manager monitoring performance and review of project planning: to include compliance with scope of work requirements and implementation of field activities; tracking of schedule, budget, materials, and equipment; compliance with regulatory requirements; identifying, recommending, and justifying modifications to the scope of work to improve performance; and review of quality control audits.

As an advisor to the Oak Ridge National Laboratory, the Interlaboratory UXO/Mine Detection Task Force and the Department of Energy Mr. Redmond provides expertise in evaluating sensor technology for UXO/mine detection geophysical surveying activities. Duties consist of evaluating sensor technology and developing realistic strategies for field trails to proof concepts, coordination with Department of Defense initiatives on UXO/mine detection to prevent redundancies in research and development. This UXO/Mine Detection Task Force consists of twelve DOE national laboratories.

As Program Manager, Ordnance Explosives/Unexploded Ordnance Cleanup of San Pedro Range, CH2M Hill, Colmenar Viejo, Spain, Mr. Redmond was responsible for the management and execution of a Firm Fixed Price contract with the Ministry of Defense of Spain to provide oversight for the removal of UXO from a 3,500 acre artillery range. The range had been in use for over 60 years and required extensive geophysical surveying to locate, remove, and dispose of surface and subsurface ordnance so that the range could be returned to the original landowners for reuse.

As Director of the UXO Service Center Mr. Redmond is responsible for providing resources to Program and Project Managers where UXO is an ancillary contaminate or to assist in

evaluating requirements for UXO support. For UXO contracts Mr. Redmond serves as the Program Manager monitoring performance and review of project planning: to include compliance with scope of work requirements and implementation of field activities; tracking of schedule, budget, materials, and equipment; compliance with regulatory requirements; identifying, recommending, and justifying modifications to the scope of work to improve performance; and review of quality control audits.

Mr. Redmond was Vice President responsible for the operation of all offices East of the Mississippi River. These responsibilities included management of environmental restoration; decontamination and decommissioning (D&D); health physics services; brokerage and transportation services; waste management services for hazardous, toxic, and radioactive wastes (HTRW); preparation of mixed waste and low level radioactive waste (LLRW) for shipment to the ATG Richland, Washington Treatment Facility; and OE/UXO/CWM services. Annual revenues for East Coast operations exceeded $12M and employed in excess of 45 permanent personnel and up to 100 project personnel.

Mr. Redmond was consultant, Lockheed Martin Energy Services, Inc. (HAZWRAP), Allied Technology Group, Inc., Fremont, California; Oak Ridge, Tennessee; Lockheed Martin Advanced Environmental Systems, Albuquerque, New Mexico; Arete` Engineering Technology Corporation, Washington, D.C. He provided expertise for development and oversight of OE/UXO activities. Included was proposal development and strategy development for Huntsville COE UXO Response contracts and the Kaho'olawe Island UXO Omnibus Contract.

He also provided review and oversight of Lockheed Martin Energy Systems, Inc. subcontractors for CERCLA/BRAC UXO/OEW characterization and remediation activities for base closure of Williams Air Force Base, Arizona and Norton Air Force Base, California to include work and safety plans, quality assurance/quality control and safety audits, and review of subcontractor recommendations for modification of contract.

As Program Manager, EOD Technology International, Ltd., Dublin, Ireland/Oak Ridge, Tennessee, Mr. Redmond was responsible for developing strategy and assisting the Marubeni Corporation of Japan in assembling a world class team to propose on the $1.2B China CWM Demilitarization Project.

Mr. Redmond was Vice President responsible for developing business strategies and management of an emerging business in a new niche market. As a Program Manager, Project Manager, and Project Engineer for EOD/UXO/OE Characterization, Remediation, and Ordnance Demilitarization contracts. His responsibilities have included management of all aspects of Ammunition Demilitarization activities and UXO clearance activities. He has had responsibility for managing the execution of multiple UXO/OE/CWM and Ordnance Demilitarization contracts including Firm Fixed Price, Cost Plus, and Time and Materials. These contracts range from long-term multiple delivery order contracts to single-order, firm fixed price contracts. This experience includes: monitoring, managing, and controlling project planning, execution, and costs; developing cost effective methods of

accomplishing the work; understanding and assuring compliance with the Regulatory Framework; and attending public meetings with government representatives. Included was a contract for conducting classified operations to disassemble and inert unknown foreign mines under RCRA regulations to determine fuzing, firing, and functioning, utilized reverse engineering disciplines to evaluate and recommend countermeasures.

Mr. Redmond co-develop an unsolicited proposal that was presented to AMCCOM to provide a "turn key" Conventional Ammunition Resource Recovery Operation. This proposal utilized for the first time a unique bio-technology for the treatment and removal of explosive residue from ammunition components, and to treat (desorb and degrade) ammunition residues that could not be recycled. Mr. Redmond helped design and develop the bio-technology system that was the basis for a sole source award by AMCCOM to "Perform Ammunition Demilitarization, Component Reutilization and Recycling of Small Arms Ammunition" that were no longer serviceable. This system met and complied with federal RCRA regulations and environmental regulations for West Virginia.

As Project Manager conducting CERCLA actions under the FUDS Program, Mr. Redmond was responsible for providing and managing the necessary resources needed to accomplish characterization and remediation of UXO/OE/CWM contaminated sites and developing information for Engineering Evaluation/Cost Analysis (EE/CA). Duties included: monitoring of performance and review of quality control audits; project planning to include compliance with the scope of work and implementation of field activities, tracking of schedule, budget, materials, and equipment; compliance with regulatory requirements; and identifying, recommending, and justifying modifications to the scope of work to improve performance. Specialized equipment resources included state-of-the-art sensors and navigation equipment, data acquisition, and data post processing to produce anomaly maps. All delivery orders were successfully completed on time and under budget.

Gary T. Webb

Unexploded Ordnance Safety Officer

Education

Associates Degree/Central Texas College

Distinguishing Qualifications

- More than 17 years experience in the Navy Explosive Ordnance Disposal Community
- Master Explosive Ordnance Disposal Technician with over 20 years of experience with the Navy Explosive Ordnance Disposal Community and the Ordnance Explosive (OE)/Unexploded Ordnance (UXO) field.
- Twenty years in leadership and management positions planning, directing and implementing all aspects of high risk operations, safety, personnel management, training, curriculum development, scheduling and budgeting.

Training

Naval Explosive Ordnance Disposal School
Naval Diving School
Mine Countermeasures Planning Training
Naval Instructor Training
Leadership and Management Training
Joint Nuclear Explosive Ordnance Disposal
40-Hour OSHA HAZWOPER - 1/98
8-Hour OSHA HAZWOPER Refresher – 3/2001
Corporate Project Managers Course- PM-200- 2/2000
Corporate 40-Hour Environmental Health and Safety Officer Training - 8/98
Corporate CFR Waste Management Training
10-Hour Construction Safety Awareness
Loss Control self study course
Backhoe Operator for UXO intrusive operations
1st Aid and CPR certified – 20 years
U. S. Army Corps of Engineers, Construction Quality Management for Contractors

Professional Affiliations

Member, International Association of Bomb Technicians & Investigations
Member, International Society of Explosive Engineers
Member, Navy Explosive Ordnance Disposal Association

Relevant Experience

Unexploded Ordnance (UXO) Safety Officer, CH2M Hill, Seattle, Washington April 2001-Present

As the UXO Safety Officer for CH2M Hill, Mr. Webb is responsible for providing Safety oversight for all OE/UXO projects, compliance with regulatory requirements; identifying, recommending, and justifying modifications to the scope of work to improve performance; and providing quality control oversight of OE project work. Current projects include:

Vieques Island OE EE/CA SWMU-4, SWMU-6 and AOC J; Mare Island OE Removal; Dahlgren, VA. OE investigation.

Unexploded Ordnance (UXO) consultant, 11/00-301, Providing review, recommendations and UXO consulting of the Adak 2000 field season reports and development of Adak field season 2001 work plans.

Unexploded Ordnance (UXO) Operations at Naval Facility, Adak Alaska, 5/00-11/00. Significant assignment as Site Superintendent, Senior UXO Supervisor and Site Health and Safety Officer while conducting UXO surface clearance, geophysical survey and intrusive investigations of over 40,000 acres of the outback area of Adak to locate, identify, remove and dispose of OE/UXO from designated areas. Foster Wheeler staff of 25 personnel are assigned as sub-contractors under Environmental Chemical Corporation (ECC) for the Navy Unexploded Ordnance Removal Contract, N.U.R.C.

Unexploded Ordnance (UXO) Technician, 11/99-5/00, Provided review, recommendations and UXO consulting of the Adak 1999 field season reports and development of Adak field season 2000 plans. Conducted extensive research of Adak Archive information.

Unexploded Ordnance (UXO) Operations at Naval Facility, Adak Alaska, 3/99- 11/99. Significant assignment as Site Superintendent, Senior UXO Supervisor and Site Health and Safety Officer while conducting UXO surface clearance, geophysical survey and intrusive investigations of over 40,000 acres of the outback area of Adak to locate, identify, remove and dispose of OE/UXO from designated areas.

UXO Operations Jackson Park and Naval Hospital Bremerton, Washington, 7/98-1/99

Significant assignment as Senior UXO Supervisor and Site Health and Safety Officer while conducting UXO surface clearance, geophysical survey and intrusive investigations to locate, identify, remove and dispose of OE/UXO from designated areas.

UXO Operations at Naval Facility, Adak Alaska, 4/98-7/98. Significant assignment as Senior UXO Supervisor, Team leader and UXO Quality Control while conducting UXO surface clearance, geophysical survey and intrusive investigations to locate, identify, remove and dispose of OE/UXO from designated areas. Over 100 hours of data acquisition using the Geonics EM-61 magnetometer and DGPS for the geophysical survey.

UXO Operations at Fort Hancock, Sandy Hook, New Jersey 2/98-3/98. Significant assignment as UXO team leader while conducting UXO surface clearance, geophysical survey and intrusive investigations to locate, identify, remove and dispose of OE/UXO from designated areas.

11/96 - 1/98 Scintrex, Tulsa, Oklahoma

Manager, Security Sales Division. Responsible for sales, marketing and training of Narcotic and Explosives detection equipment. Customer base is law enforcement, private, corporate and industrial security, military and Federal agencies.

Gary T. Webb

3/75 - 11/96 United States Navy

3/94 - 11/96 Explosive Ordnance Disposal Mobile Unit ELEVEN, Whidbey Island, Washington, Readiness and Training Officer. Developed, scheduled and directed training for 120 command personnel. Maintained mission essential training, including diving, explosive demolition, parachute operations and response team evaluations.

3/91 - 3/94 Explosive Ordnance Disposal Mobile Unit THREE, Coronado, California, Assistant Operations Officer and EOD team Officer in Charge. Planned, coordinated and managed EOD operations and logistics for deploying units and exercises. OIC of a 24 member detachment, training 6 Bottlenose Dolphins for the Navy's Marine Mammal program. OIC of a 7-man team specialized in Mine countermeasures and mixed gas diving.

10/88 - 3/91 Explosive Ordnance Disposal Mobile Unit NINE, Detachment Keyport, Washington, Assistant Officer in Charge. Responsible for EOD, UXO and diving response in the Pacific Northwest.

6/87 - 10/88 Naval Explosive Ordnance Disposal School, Instructor. Provided training to EOD basic students in the Aviation Ordnance and Mine Warfare Divisions. Commissioned as a Naval Officer.

5/83 - 6/87 Explosive Ordnance Disposal Detachment, Sasebo, Japan. Provided EOD emergent response and diving services in Japan and Korea.

3/82 - 4/83 Explosive Ordnance Disposal Mobile Unit ONE, Barbers Point, Hawaii. Provided EOD and diving services in the Hawaiian Islands, Japan and the Pacific. Deployed with the USS Midway battle group.

1/81 -1/82 Naval Explosive Ordnance Disposal School, Student. Received basic EOD, diving and parachute training.

APPENDIX C

Personnel Qualification Verification Forms

FORM 2-1

UXO INFORMATION FORM

DATE/TIME: _____ TRACKING NUMBER: _____
LOCATION: _____

1. ITEMS REMOVED FROM SITE (YES/NO)

2. WHO REMOVED THE ITEM(S)?
   Name:_____ Organization: _____

3. IF ITEMS WERE REMOVED, WHERE WERE THEY TAKEN? _____
   _____

4. ITEMS DESTROYED ONSITE (YES/NO)

5. WHO DESTROYED ITEM(S)?
   Name: _____ Organization: _____
   Time of Detonation:_____ UXO Down Time:_____

6. ORDNANCE ITEMS ENCOUNTERED:

Type	Quantity	Condition	Disposition

7. USACE NOTIFIED AT (TIME): _____ REP: _____

8. IT PERSONNEL NOTIFIED AT (TIME): _____ REP: _____

9. COMMENTS (Significant events or findings): _____
   _____
   _____
   _____

_____ _____
IT UXO Representative (Signature) IT UXO Representative (Print Name)

CHECKED BY _____	APPROVED BY _____

Form 2-2

Grid Summary Sheet

Grid ID	Team #	Grid Dimensions	Area (sq ft)	Geophysical Instrument
		x		

Personnel:

Title	Name
Technician III	
Technician II	
Technician II	
Technician II	
Technician II	

Number of Anomalies	
Original	
Corps QA	%
Total	

Scrap Weight (lbs)
OE
Non-OE

WORK RECORD

Date	Grid Prep Hours	Survey Hours	Excavation Hours	QA Hours	Demo Hours	Restoration Hours	Total Hours
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
							0
Total	0	0	0	0	0	0	0

Name	Reviewed by	Signature	Date
	Team Leader		
	SUXOS		
	QC		

Form 2-3

ANOMALY TRACKING SHEET

Grid Origin Coordinates:		E		N		Grid ID:									
SURVEY DATA				REACQUISITION DATA			POST-DIG DATA						DIG RESULT		
Data Supplied to the Field Teams				Data Collected by the Field Geophysical Team									Data Collected by the UXO Team		
Anomaly ID	Survey Easting (ft)	Survey Northing (ft)	Total Reading (mV)	Reacquire Easting (ft)	Reacquire Northing (ft)	Reacquire Comments	Pre-Dig Reading (mV)	Post-Dig Reading (mV)	Item Easting (ft)	Item Northing (ft)	Post-Dig Completion Comments: a. 90% of peak removed from signal b. large item not removed from hole c. hole reached 4 ft; source is deeper d. other (specify)	Initial when dig is considered complete	Type: U = UXO F = Frag O = Non-OE	Depth (inches)	Item Description

Form 2-4

UXO TRACKING SHEET

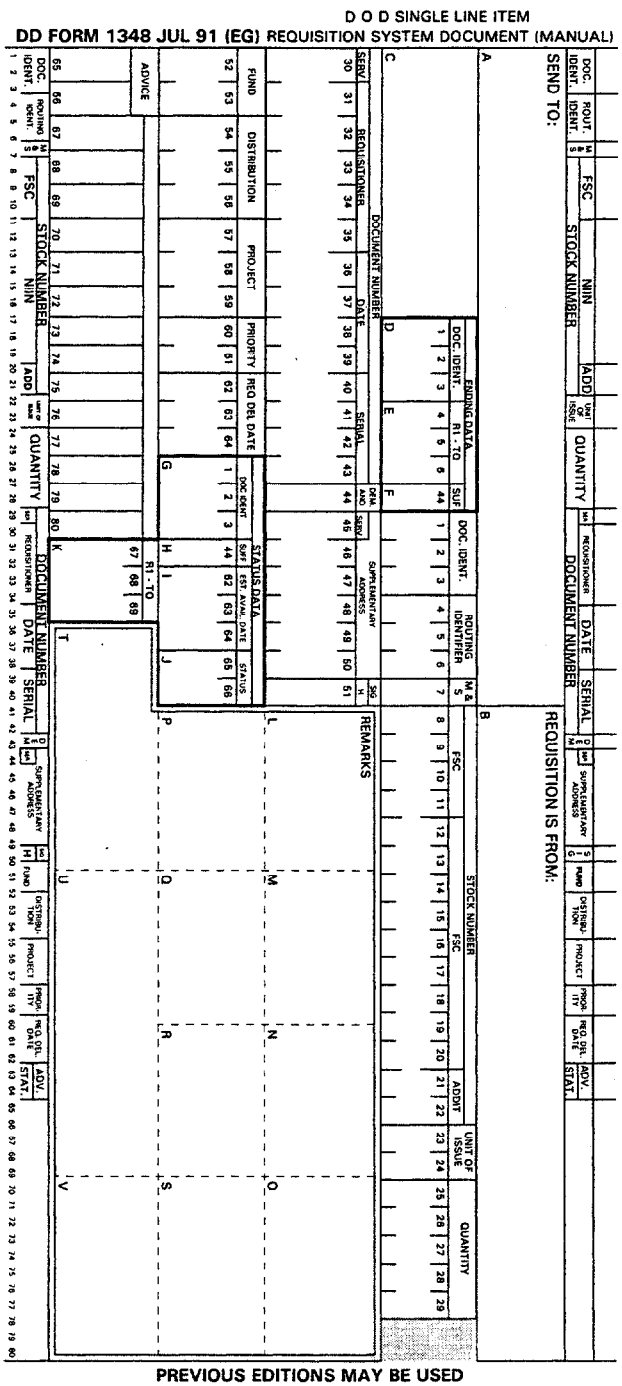
Grid ID												
Anomaly ID	Easting (ft)	Northing (ft)	Depth to Tip (in)	Depth to Tail (in)	Orientation (N,S,E,W)	Type	Filler	Fuse	Date Found	Disposal (BIP, PUCA Demo, EOD)	Date Disposed	Comments

FORM 2-5

SCRAP CERTIFICATION FORM

USE ☐ TYPEWRITER OR BALL POINT PRESS HERE ☐ PEN

TO ASSURE LEGIBILITY ON ALL COPIES



Form 3-1

MOTOR VEHICLE INSPECTION
(TRANSPORTING HAZARDOUS MATERIAL)

GBL. NO.	ORIGIN	DESTINATION
NAME OF CARRIER		
AME OF DRIVER		
DATE AND HOUR		
INSTALLATION/ACTIVITY	FORT ORD, CALIFORNIA	
DIVER=S STATE PERMIT NO.		
MEDICAL EXAMINER=S CERTIFICATE AND DATE		

VEHICLE

TYPE OF VEHICLE	TRUCK NUMBER	TRAILER(S) NUMBER	SLEEPER CAB
_ TRUCK Q TRUCK AND FULL TRAILER Q TRACTOR AND DOUBLE TRAILERS Q TRACTOR AND CLOSED SEMI-TRAILER Q TRACTOR AND FLAT-BED TRAILER	ORIGIN DESTINATION	ORIGIN DESTINATION	Q YES _ NO VALID LEASE _ YES Q NO 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 SAT	ORIGIN UNSAT	DESTINATION SAT	DESTINATION UNSAT	REMARKS *(Explain unsatisfactory items; use reverse side if necessary)*
1.	ENGINE, BODY, CAB AND CHASSIS CLEAN					
2.	STEERING MECHANISM					
3.	HORN OPERATIVE					
4.	WINDSHIELD AND WIPERS					
5.	SPARE ELECTRIC FUSES AVAILABLE					
6.	REAR VIEW MIRRORS INSTALLED					
7.	HIGHWAY WARNING EQUIPMENT					
* 8.	FULL FIRE EXTINGUISHER INSTALLED (2)					
9.	LIGHTS AND REFLECTORS OPERATIVE					
10.	EXHAUST SYSTEM					
12.	FUEL TANK, LINE AND INLET					
* 14.	ALL BRAKES OPERATIVE					
16.	SPRINGS AND ASSOCIATED PARTS					
* 17.	TIRES					
18.	CARGO SPACE					
* 19.	ELECTRIC WIRING					
* 20.	TAIL GATE AND DOORS SECURED					
22.	ANY OTHER DEFECTS *(Specify)*					

Q APPROVED Q REJECTED *(If rejected give reasons on reverse under ARemarks.@ 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
23.	MIXTURES OF MATERIAL PROHIBITED BY DOT REGS. ARE NOT LOADED ONTO THIS VEHICLE		
* 24.	LOAD IS SECURED TO PREVENT MOVEMENT		
25.	WEIGHT IS PROPERLY DISTRIBUTED AND VEHICLE IS NOT OVERWEIGHT		
* 27.	SPECIAL INSTRUCTIONS *(DD Form 836)* FURNISHED DRIVER		
* 28.	COPY OF VEHICLE INSPECTION *(DD Form 626)* FURNISHED DRIVER		
* 29.	PROPER PLACARDS APPLIED		
* 30.	SHIPMENT MADE UNDER DOT EXCEPTION 868		

SIGNATURE *(of Inspector)* ORIGIN	SGNATURE *of Driver)* ORIGIN
SIGNATURE *(of Inspector)* DESTINATION	SIGNATURE *of Driver)* DESTINATION

COPY OF **DD FORM 626** REPLACES EDITION OF 1 JUN 72, WHICH IS OBSOLETE.

Form 3-2

MAGAZINE DATA CARD

NOMENCLATURE_____ LOT NO:_____

DATE	QTY OUT	QTY IN	ACTION	USER	BALANCE

_____ _____

UXO Supervisor Date

Form 3-3

ATF Form 5400.5 Report of Theft or Loss – Explosive Materials

(form available in hard copy only)

CH2MHILL

FORM 9-1
PERSONNEL QUALIFICATION VERIFICATION FORM

CANDIDATE: _____ **POSITION:** _____

CONTRACT: N62470-95-D-6007

REVIEW ITEMS		CANDIDATE QUALIFICATIONS	VERIFIED BY/DATE
EXPERIENCE	REQUIRED: AREA AND YEARS		
	ACTUAL: AREA AND YEARS		
EDUCATION	REQUIRED		
	ACTUAL		
CERTIFICATIONS & REGISTRATIONS	REQUIRED		
	ACTUAL		
TRAINING	REQUIRED		
	ACTUAL		
OTHER	REQUIRED		
	ACTUAL		

CH2MHILL

FORM 9-2

DOCUMENT REVIEW AND RELEASE FORM

Client:	Author:	Submittal Register Item No.:	Date:
Document Title:		Revision:	

Reviewer (*print*)	Reviewer initial & date	Technical	Project Manager	CQC System Mgr.	Health & Safety	Editorial	Chemistry	Construction	Reviewer Comments Resolved (*Signature & Date*)
Same as Technical Reviewer Above		X	Topic outline with objectives for each section submitted prior to Rev. A						

Program Reviewer's Acceptance for Document Submittal	Signature	Yes	No
1) Technical Conclusions adequately supported by text and data?			
2) Tables and Figures are in the proper format and checked and approved?			
3) The Table of Contents consistent with text information?			
4) Technical Reviewers are qualified and accepted by Program Technical Manager?			
5) A document Distribution List been prepared and submitted with document?			

Approval:

_____

Project Manager

Approval:

_____

Program CQC System Manager

CH2MHILL

FORM 9-3

PREPARATORY INSPECTION CHECKLIST
(PART I)

Contract No.: N62470-95-D-6007
Task Order No.
NASD, Vieques

Date: _____

Title and No. of Technical Section: _____

_____

_____

_____

Reference Contract Drawings: _____

A. Planned Attendants:

	Name	Position	Company
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			
9)			
10)			
11)			

B. Submittals required to begin work:

	Item	Submittal No.	Action Code
1)			
2)			
3)			
4)			
5)			
6)			
7)			
8)			

I hereby certify, that to the best of my knowledge and belief, that the above required materials delivered to the job site are the same as those submitted and approved.

_____
Contractor Quality Control Systems Manager

(continued):

FORM 9-3

CH2MHILL

PREPARATORY INSPECTION CHECKLIST
(PART I)

Contract No.: N62470-95-D-6007
Task Order No.
NASD, Vieques

Date: _____

C. Equipment to be used in executing work:

1) _____
2) _____
3) _____
4) _____
5) _____

D. Work areas examined to ascertain that all preliminary work has been completed:

_____
_____

E. Methods and procedures for performing Quality Control, including specific testing requirements:

_____
_____

The above methods and procedures have been identified from the project plans and will be performed as specified for the Definable Feature of Work.

_____
Contractor Quality Control Systems Manager

FORM 9-3

PREPARATORY INSPECTION CHECKLIST
(PART II)

A. Persons in attendance: See Meeting Attendance Sheet (attached)

B. Because of mutual understanding developed during review of preparatory outline and Contract Requirements: (Contract items not specifically covered during the preparatory inspection conference are assumed to be in strict conformance with the contract requirements.)

The items noted above constitute a memorandum of mutual understanding and will be performed as planned and specified.

CH2MHILL CQCSM

Navy Technical Representative

CH2MHILL

FORM 9-4

INITIAL PHASE INSPECTION CHECK LIST

Contract No.: N62470-95-D-6007
Task Order No
NASD, Vieques

Date: _____

Title and No. of Technical Section: _____

Description and Location of Work Inspected: _____

Reference Contract Drawings: _____

A. Key Personnel Present:

	Name	Position	Company
1)			
2)			
3)			
4)			
5)			

B. Materials being used are in strict compliance with the contract plans and specifications: Yes ____ No ____

If not, explain: _____

C. Procedures and/or work methods witnessed are in strict compliance with the contract specifications: Yes ____ No ____

If not, explain: _____

D. Workmanship is acceptable: Yes ____ No ____

State where improvement is needeed: _____

E. Workmanship is free of safety violations: Yes ____ No ____

If no, corrective action taken: _____

_____
Contractor Quality Control Representative

CH2MHILL

FORM 9-5

FOLLOW-UP PHASE INSPECTION CHECKLIST

CONTRACTOR QUALITY CONTROL WEEKLY REPORT CONTINUATION SHEET (ATTACH ADDITIONAL SHEETS IF NECESSARY)

Date:
Contractor: CH2M HILL
Contract No: N62470-95-D-6007 Task Order No: Report No:_____

Y=YES; N=NO; SEE REMARKS BLANK=NOT APPLICABLE	
WORK COMPLIES WITH CONTRACT AS APPROVED IN INITIAL PHASE	

IDENTIFY DEFINABLE FEATURE OF WORK, LOCATION, AND LIST PERSONNEL PRESENT

TESTING PERFORMED & WHO PERFORMED TEST (Include number of samples and/or tests taken)

_____ _____
Navy QA Representative **Date**

_____ _____
Contractor's QC Representative **Date**

CH2MHILL

FORM 9-6

FINAL INSPECTION CHECKLIST
(PART I)

Date:_____

Contract No.: N62470-95-D-6007
Task Order No. ____ Project No. _____
NASD, Vieques

Project / Area of Inspection: _____

A. Definable Features of Work: Status of Inspection:

I hereby certify, that to the best of my knowledge and belief, that the work inspected is complete and all materials and equipment used and work performed were completed in accordance with plans submitted and approved.

_____
Contractor Quality Control Systems Manager

B. Final Acceptance is Approved, Subject to the Correction of the Punchlist Items Below:

(continued):

FORM 9-6

FINAL INSPECTION CHECKLIST
(PART I)

Date:_____

Contract No.: N62470-95-D-6007
Project No. _____ Task Order No. _____
NASD, Vieques

A. Persons in Attendance: See Meeting Attendance Sheet (attached)

B. Resolution of Punchlist Items:

The items noted above constitute a memorandum of mutual understanding and work has been performed as planned and specified.

FORM 9-6

FINAL INSPECTION CHECKLIST
(PART II)

MEETING ATTENDANCE LIST

Meeting:		Date:
Name	Organization	Phone Number

CH2MHILL

FORM 9-7

INSPECTION SCHEDULE AND TRACKING FORM

Project: NASD, Vieques	Project Manager:	CQC System Manager:

Reference Number	Definable Feature of Work	Preparatory		Initial		Follow-Up		Completion		
		Date Planned	Actual Date	Date Planned	Actual Date	Planned Begin/End	Actual Dates	Planned Begin/End	Actual Dates	Status

CH2MHILL

FORM 9-8
CORRECTIVE ACTION REQUEST

[2]CAR #:	[3]PRIORITY: __HIGH __NORMAL	[4]DATE PREPARED:

PART A: NOTICE OF DEFICIENCY

[5]PROJECT: NASD, Vieques	CTO #:
[6]PROJECT MANAGER:	[7]CQC SYSTEM MANAGER:
[8]WORK UNIT:	[9]WORK UNIT MANAGER:
[10]ISSUED TO (INDIVIDUAL & ORGANIZATION):	
[11]REQUIREMENT & REFERENCE:	
[12]PROBLEM DESCRIPTION & LOCATION: [13]CAP REQUIRED? __YES __NO [14]RESPONSE DUE:	
[15]ISSUED BY (PRINTED NAME & TITLE): SIGNATURE: DATE:	[16]MANAGEMENT CONCURRENCE:

PART B: CORRECTIVE ACTION

[17]PROPOSED CORRECTIVE ACTION/ACTION TAKEN: NOTE: SUPPORTING DOCUMENTATION MUST BE LISTED ON THE BACK OF THIS FORM AND ATTACHED.	
[18]PART B COMPLETED BY (NAME & TITLE): SIGNATURE: DATE:	[19]QC CONCURRENCE:

PART C: CORRECTIVE ACTION VERIFICATION

[20]CAR VERIFICATION AND CLOSE-OUT: (CHECK ONLY ONE & EXPLAIN STIPULATIONS, IF ANY)

__APPROVED FOR CLOSURE WITHOUT STIPULATIONS

__APPROVED FOR CLOSURE WITH FOLLOWING STIPULATIONS

COMMENTS/STIPULATIONS:

[21]CLOSED BY (PRINTED NAME & TITLE):

SIGNATURE: DATE:

CH2MHILL

CORRECTIVE ACTION REQUEST (CAR) INSTRUCTION SHEET

(1) **CQC System Manager:** Verify that the total number of pages includes all attachments.

(2) **CQC System Manager:** Fill in CAR number from CAR log.

(3) **CQC System Manager:** Fill in appropriate priority category. **High** priority indicates resolution of deficiency requires expediting corrective action plan and correction of deficient conditions noted in the CAR and extraordinary resources may be required due to the deficiency=s impact on continuing operations. **Normal** priority indicates that the deficiency resolution process may be accomplished without further impacting continuing operations.

(4) **CAR Requestor:** Fill in date CAR is initiated.

(5) **CAR Requestor:** Identify project name, number, CTO, and WAD.

(6) **CAR Requestor:** Identify Project Manager

(7) **CAR Requestor:** Identify CQC System Manager.

(8) **CAR Requestor:** Identify project organization, group, or discrete work environment where deficiency was first discovered.

(9) **CAR Requestor:** Identify line manager responsible for work unit where deficiency was discovered.

(10) **CQC System Manager:** Identify responsible manager designated to resolve deficiency (this may not be work unit manager).

(11) **CAR Requestor:** Identify source of requirement violated in contract, work planning document, procedure, instruction, etc; use exact reference to page and, when applicable, paragraph.

(12) **CAR Requestor:** Identify problem as it relates to requirement previously stated. Identify location of work activities impacted by deficiency.

(13) **CQC System Manager:** Identify if Corrective Action Plan (CAP) is required. CAP is typically required where one or more of the following conditions apply: CAR priority is **High**; deficiency requires a rigorous corrective action planning process to identify similar work product or activities affected by the deficiency; or deficiency requires extensive resources and planning to correct the deficiency and to prevent future recurrence.

(14) **CQC System Manager:** Identify date by which proposed corrective action is due to QC for concurrence.

(15) **CQC System Manager:** Sign and date CAR and forward to responsible manager identified in (10) above.

(16) **Responsible Manager:** Initial to acknowledge receipt of CAR.

(17) **Responsible Manager:** Complete corrective action plan and identify date of correction. Typical corrective action response will include statement regarding how the condition occurred, what the extent of the problem is (if not readily apparent by the problem description statement in [12]), methods to be used to correct the condition, and actions to be taken to prevent the condition from recurring. If a CAP is required, refer to CAP only in this section.

(18) **Responsible Manager:** Sign and date corrective action response.

(19) **CQC System Manager:** Initial to identify concurrence with corrective action response from responsible manager.

(20) **CQC System Manager:** Check appropriate block to identify if corrective action process is complete so that CAR may be closed. Add close-out comments relevant to block checked.

(21) **CQC System Manager:** Indicate document closeout by signing and dating.

CH2MHILL

FORM 9-9

CORRECTIVE ACTION PLAN

Attach clarifications and additional information as needed. Identify attached material in appropriate section of this form.

PART A: TO BE COMPLETED BY PROJECT MANAGER OR DESIGNEE

(1)PROJECT: NASD, Vieques		
(2)PROJECT MANAGER:	(3)CQC SYSTEM MANAGER:	
(4)CAR NO(S) AND DATE(S) ISSUED:		
(5)DEFICIENCY DESCRIPTION AND LOCATION:		
(6)PLANNED ACTIONS	(7)ASSIGNED RESPONSIBILITY	(8) COMPLETION DUE DATE
(9)PROJECT MANAGER SIGNATURE:	DATE:	

PART B: TO BE COMPLETED BY CQC SYSTEM MANAGER OR DESIGNEE

(10)CAP REVIEWED BY: DATE:
(11)REVIEWER COMMENTS:
(12)CAP DISPOSITION: (CHECK ONLY ONE AND EXPLAIN STIPULATIONS, IF ANY) _____ APPROVED WITHOUT STIPULATIONS _____ APPROVED WITH STIPULATIONS _____ APPROVAL DELAYED, FURTHER PLANNING REQUIRED COMMENTS:
(13)CQC SYSTEM MANAGER SIGNATURE: DATE:

CH2MHILL

FORM 9-10

WEEKLY QUALITY CONTROL REPORT

Contract No. N62470-95-D-6007
Task Order No. _____
Project No. _____

Date: _____

Report No: _____

LOCATION OF WORK: _____

DESCRIPTION: _____

WEATHER: (CLEAR) (FOG) (P.CLOUDY) (RAIN) (WINDY)

TEMPERATURE: MIN____°F MAX____°F

1. Work performed today:

_____

_____

2. Work performed today by CH2MHILL subcontractor(s):

_____

_____

_____

3. Preparatory Phase Inspections performed today (include personnel present, specification section, drawings, plans, and submittals required for definable feature of work):

_____

_____

4. Initial phase Inspections performed today (include personnel present, workmanship standard established, material certifications/test are completed, plans and drawings are reviewed):

_____

_____

5. Follow-up Phase Inspections performed today (include locations, feature of work and level of compliance with plans and procedures):

_____

_____

_____

_____

CH2MHILL

FORM 9-10

WEEKLY QUALITY CONTROL REPORT

Contract No. N62470-95-D-6007
Task Order No. _____
Project No. _____

Date: _____

Report No: _____

6. List tests performed, samples collected, and results received:

_____

_____

_____

6. Verbal instructions received (instructions given by Government representative and actions taken):

_____

_____

_____

7. Non-conformances/deficiencies reported:

_____

_____

_____

8. Site safety monitoring activities performed today:

_____

_____

9. Remarks:

_____

_____

_____

_____

CERTIFICATION: I certify that the above report is complete and correct and that I, or my representative, have inspected all work identified on this report performed by CH2M HILL and our subcontractor(s) and have determined to the best of my knowledge and belief that noted work activities are in compliance with the plans and specifications, except as may be noted above.

_____
Contractor Quality Control Systems Manager