*FINAL*

# *Site-Specific Final Report*

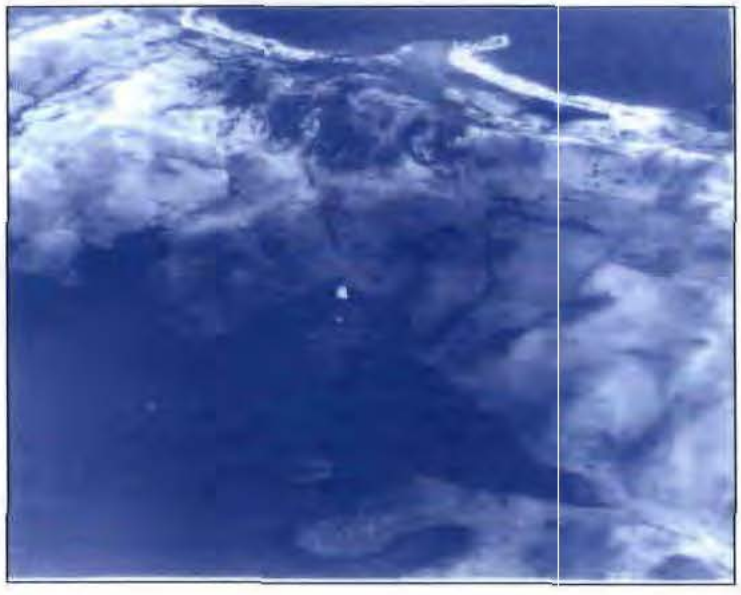
## Non-Time-Critical Removal Action at the Municipality of Culebra, Puerto Rico

*Prepared for*

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

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

Geographical District: Jacksonville – Antilles Region



*Prepared by*

Ellis Environmental Group, LC
15020 NW U.S. Hwy. 441, Alachua, FL 32615 • (386) 418-8210

February 2009

200-1e
I02PR006802_02.13_0006

*FINAL*

# *Site-Specific Final Report*

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

*Prepared for*

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

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

Geographical District: Jacksonville – Antilles Region

*Prepared by*

Ellis Environmental Group, LC
15020 NW U.S. Hwy. 441, Alachua, FL 32615 • (386) 418-8210

February 2009

**The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.**

*FINAL*

# SITE-SPECIFIC FINAL REPORT
# Non-Time-Critical Removal Action
# at the
# Municipality of Culebra, PR

US Army District, Jacksonville
US Army Engineering & Support Center, Huntsville
Contract # W912DY-05-D-0007, TO #0001

## Independent Technical Review Certification

| Responsibility Name | Company | Signature & Date |
|---|---|---|
| **Authors**<br>Gary Tourtellotte<br>Mark G. Bagel, PG | EEG | 2/20/09 |
| **Project Manager**<br>Mark G. Bagel, PG | EEG | 2/20/09 |

# Contents

*Abbreviations & Acronyms* ..... *iii*

**1.0 Introduction ..... 1-1**

1.1 Project Authority ..... 1-1
1.2 Military Munitions Response Program History at Culebra ..... 1-2
1.3 Project Objective ..... 1-2
1.4 Regional Description ..... 1-2
1.4.1 Site Description ..... 1-3
1.4.2 Site History ..... 1-4
1.4.3 MEC Hazards ..... 1-5
1.5 Topography ..... 1-5
1.6 Geology ..... 1-5
1.7 Surface Water ..... 1-6
1.8 Climate ..... 1-6
1.9 Future Use ..... 1-6
1.10 Site Utilities ..... 1-7
1.11 Vegetation ..... 1-7
1.11.1 Cerro Balcon ..... 1-7
1.11.2 Cayo Lobo ..... 1-8
1.11.3 Isla Culebrita ..... 1-8
1.12 Cultural Resources ..... 1-9
1.12.1 Cerro Balcon ..... 1-9
1.12.2 Cayo Lobo and Isla Culebrita ..... 1-10

**2.0 MEC Investigation and Removal ..... 2-1**

2.1 Field Change Requests ..... 2-1
2.2 Site Accessibility and Impediments ..... 2-1
2.2.1 Cerro Balcon ..... 2-1
2.2.2 Cayo Lobo ..... 2-2
2.2.3 Isla Culebrita ..... 2-2
2.3 Explosives Control and Accountability ..... 2-3
2.4 Major Stages of Work ..... 2-3
2.4.1 Pre-Field Activities ..... 2-4
2.4.2 Site Preparation ..... 2-4
*2.4.2.1 Grid Corner Location Survey ..... 2-4*
*2.4.2.2 Vegetation Clearance ..... 2-5*
2.4.3 Identification, Segregation, and Removal of MPPEH ..... 2-6
*2.4.3.1 MPPEH Locations at Cerro Balcon ..... 2-7*
*2.4.3.1.1 Grids Completed at Cerro Balcon ..... 2-8*
*2.4.3.1.2 MEC Items at Cerro Balcon ..... 2-9*
*2.4.3.2 MPPEH Locations at Cayo Lobo ..... 2-11*
*2.4.3.2.1 Grids Completed at Cayo Lobo ..... 2-11*
*2.4.3.2.2 MEC Items at Cayo Lobo ..... 2-13*
2.4.4 Management and Disposal of Munitions Debris ..... 2-16

*2.4.4.1 Munitions Debris at Cerro Balcon* ..... *2-16*
*2.4.4.2 Munitions Debris at Cayo Lobo* ..... *2-18*
2.4.5 UXO Quality Assurance / Quality Control ..... 2-19
2.5 Soil Sample Collection and Analyses ..... 2-21
2.5.1 Soil Samples from Cerro Balcon ..... 2-22
2.5.2 Soil Samples from Cayo Lobo ..... 2-25

**3.0 Lessons Learned ..... 3-1**

3.1 Schedule Impacts ..... 3-1
3.2 Explosives Operation Coordination ..... 3-1
3.3 Communications and Security ..... 3-2
3.4 Explosives Transport ..... 3-2
3.5 Explosives Disposal ..... 3-2
3.6 Munitions Debris Disposal ..... 3-2
3.7 Vegetation Clearing ..... 3-3

**4.0 Summary ..... 4-1**

4.1 Removal Action ..... 4-1
4.2 Environmental Sampling ..... 4-2
4.3 Field Effort Costs ..... 4-2

**5.0 Conclusions ..... 5-1**

**6.0 References ..... 6-1**

## *Tables*

Table 2-1. Cerro Balcon Grids Completed ..... 2-8
Table 2-2. MEC Items Located and Demilled at Cerro Balcon ..... 2-10
Table 2-3. Cerro Balcon Demolition Operations ..... 2-10
Table 2-4. Cayo Lobo Grids Completed ..... 2-11
Table 2-5. MEC Items Located and Demilled at Cayo Lobo ..... 2-13
Table 2-6. Cayo Lobo Demolition Operations ..... 2-15
Table 2-7. Field Weight of Munitions Debris Removed from Cerro Balcon ..... 2-17
Table 2-8. Field Weight of Munitions Debris Removed from Cayo Lobo ..... 2-18
Table 2-9. Quality Control Checks, Parameters, and Corrective Actions ..... 2-19
Table 2-10. Surface Soil Samples Collected at Cerro Balcon ..... 2-22
Table 2-11. Analyses Conducted on Surface Soil Samples Collected at Cerro Balcon ..... 2-23
Table 2-12. Basic Statistics: Metals at Cerro Balcon ..... 2-24
Table 2-13. Surface Soil Samples Collected at Cayo Lobo ..... 2-25
Table 2-14. Analyses Conducted on Surface Soil Samples Collected at Cayo Lobo ..... 2-27
Table 2-15. Perchlorate Detected at Cayo Lobo ..... 2-28
Table 2-16. Explosives Detected at Cayo Lobo ..... 2-28
Table 2-17. Basic Statistics: Metals at Cayo Lobo ..... 2-29

## Appendices

Appendix A. Scope of Work
Appendix B. Figures
Appendix C. SUXOS Daily Reports
Appendix D. Field Change Requests
Appendix E. Grid Corner Locations and Survey Data
Appendix F. MEC Activities Photographs
Appendix G. Form 948s
Appendix H. MEC Items Photographs
Appendix I. Munitions Debris Tracking
Appendix J. Chemical Data Quality Control Summary Report
Appendix K. Analytical Detections and Database

## Abbreviations & Acronyms

| | |
|---|---|
| °F | degrees Fahrenheit |
| µg | microgram |
| ASR | Archives Search Report |
| CEHNC | United States Army Engineering and Support Center, Huntsville |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CESAJ | United States Corps of Engineers Jacksonville District |
| CRREL | Cold Regions Research and Engineering Laboratory |
| DDESB | Department of Defense Explosives Safety Board |
| DERP | Defense Environmental Restoration Program |
| DNER | Department of Natural and Environmental Resources |
| DoD | Department of Defense |
| EE/CA | Engineering Evaluation / Cost Analysis |
| EEG | Ellis Environmental Group, LC |
| EPA | Environmental Protection Agency |
| EQB | Environmental Quality Board |
| ESE | Environmental Science and Engineering, Inc. |
| FAA | Federal Aviation Administration |
| FBI | Federal Bureau of Investigation |
| FUDS | Formerly Used Defense Site |
| FWS | Fish and Wildlife Service |
| GPS | global positioning system |
| HMX | octahydro-1,3,5,7-tetranitro-1,3,5,7 tetrazocine |
| kg | kilogram |
| MEC | munitions of explosive concern |
| mg | milligram |
| mm | millimeter |
| MMRP | Military Munitions Response Program |
| MPPEH | material potentially presenting an explosive hazard |

| | |
|---|---|
| NAD | North American Datum |
| NG | nitroglycerin |
| OE | ordnance and explosives |
| PETN | pentaerythritol tetranitrate |
| PPE | personal protective equipment |
| QA | quality assurance |
| QC | quality control |
| SASR | Supplemental Archives Search Report |
| STL | Severn Trent Laboratories |
| SUXOS | senior unexploded ordnance supervisor |
| TAL | Target Analyte List |
| TAZ | Tractor Accessorized Zerriest |
| TES | Timberline Environmental Services, Inc. |
| USACE | United States Army Corps of Engineers |
| UTM | Universal Transverse Mercator |
| UXO | unexploded ordnance |
| UXOQC/SO | unexploded ordnance quality control / safety officer |

# 1.0 Introduction

Ellis Environmental Group, LC (EEG) of Newberry, Florida, was contracted by the United States Army Engineering and Support Center, Huntsville (CEHNC), under contract W912DY-05-D-0007, Task Order 0001, to conduct a non-time-critical removal action at Cerro Balcon and several cays surrounding Culebra Island, Puerto Rico. This work was conducted in response to the 1997 Action Memorandum prepared by Environmental Science and Engineering, Inc. (ESE 1997). EEG received a written notice to proceed with the surface removal action on April 4, 2006. The scope of work is provided as **Appendix A** of this report. The work was conducted in accordance with the approved Final Work Plan (EEG 2006).

## 1.1 Project Authority

1.1.01 The Culebra Island region was formerly used by the United States Navy and the United States Marine Corps as a training range. The Findings and Determination of Eligibility, dated December 24, 1991, qualified 2,660 acres of Culebra Island and adjacent cays as eligible for consideration under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS).

1.1.02 FUDS are sites that were formerly owned, leased, or otherwise possessed by the Department of Defense (DoD). Although these properties may be presently owned by private citizens, local governments, or private organizations, DoD will address contamination problems caused by DoD while DoD owned, leased, or possessed the land. The Culebra National Wildlife Refuge is located on such a facility.

1.1.03 The authority given to the United States Army Corps of Engineers (USACE) generally falls under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). USACE is the lead response agency for CERCLA projects on FUDS sites. At the Culebra National Wildlife Refuge facility, the Puerto Rico Environmental Quality Board (EQB) is the lead environmental regulatory agency and coordinates with USACE. Responsibility for the response actions at this site have been assigned to USACE Jacksonville District (CESAJ). CEHNC is responsible for assessing this site under the Military Munitions Response Program (MMRP).

## 1.2 Military Munitions Response Program History at Culebra

1.2.01 In 1995, USACE Rock Island District prepared an Archives Search Report (ASR) (USACE 1995). The ASR identified the suspected types, quantities, and probable locations of ordnance and explosives remaining on Culebra Island and in the Culebra National Wildlife Refuge. The ASR identified 32 suspected areas, of which 13 were verified as key problem sites.

1.2.02 In November 1995, ESE conducted an Engineering Evaluation / Cost Analysis (EE/CA) of several of the suspected unexploded ordnance (UXO) sites identified in the ASR and recommended surface removal of ordnance and explosives (OE) as the preferred remedial alternative (ESE 1996). An Action Memorandum for surface removal at those sites (ESE 1997) was approved by USACE in March 1997.

1.2.03 In September 2005, USACE St. Louis District prepared the MMRP Supplemental Archives Search Report (SASR) for Property No. I02PR0068, Culebra, Puerto Rico, in support of DERP-FUDS. The SASR compiled information obtained through historical research at various archives and records holding facilities and supplemented the findings of the ASR. (Plate 2 of the SASR summarizes the results of the supplemental search.) Based on subsequent review of historical material from the National Archives, it was determined that all of Culebra Island and the adjacent cays should be considered a FUDS, and they are being diligently investigated by CESAJ. **Figure B1 (Appendix B)** of this report is a map of Culebra Island and the surrounding cays that shows the locations of the removal areas.

## 1.3 Project Objective

The objective of this munitions response is a removal action at the former naval facility located on Culebra Island and the surrounding cays. The task order was initiated to implement the surface removal actions presently approved in the Action Memorandum at Cerro Balcon, Isla Culebrita, Cayo Botella, Cayo Tiburon, Los Gemelos, Cayo del Agua, Cayos Geniqui, Cayo Lobo, and Cayo Alcarraza.

## 1.4 Regional Description

1.4.01 Culebra Island is approximately 17 miles east of Puerto Rico across Vieques Sound. The Caribbean Sea lies to the south, and the Atlantic Ocean lies to the north. St. Thomas of the United States Virgin Islands is approximately 12 miles east of Culebra.

1.4.02 Adjacent to Culebra Island are about 24 cays, mostly owned by the United States Fish and Wildlife Service (FWS). The total land area is approximately 7,300 acres, of which approximately 1,500 acres are owned by FWS. Approximately 1,200 acres are primarily in the custody of the Puerto Rico Department of Natural and Environmental Resources (DNER), and approximately 4,600 acres are owned by private citizens and the Municipality of Culebra.

### 1.4.1 Site Description

1.4.1.01 The former Cerro Balcon range is located in the east-central part of Culebra Island on the western slope of Cerro Balcon. The ASR identified the site as having been used by the United States Marine Corps for mortar and combat range training areas. Additionally, the SASR reported that the site falls within the historic safety fan of the artillery firing range. The area encompasses approximately 30 acres and extends from the southern part of the San Isidro region of the island to the northern part of the Fraile region. Part of the area is fenced. The entire area is privately owned and has been used primarily for livestock grazing, but portions are currently being developed as residential property. Public access to the area is not restricted except as restricted by the landowner, poor roads, thick vegetation, and fencing. The Action Memorandum recommended surface clearance as the remedial alternative for this site.

1.4.1.02 On Isla Culebrita, located just east of Culebra Island, the work area included 82 acres in the northwest sector of the island formerly used as a strafing range. Isla Culebrita is administered by FWS and is accessible only by boat. Current use is recreation, including swimming, boating, and hiking. Approximately 21,000 people visit the island annually. The north bay of Isla Culebrita is a popular area for boaters and beach visitors. FWS would like to develop hiking trails into the northwest sector of the island. The Action Memorandum recommended surface clearance as the remedial alternative for this site.

1.4.1.03 Cayo Botella, Cayo Alcarraza, Los Gemelos, Cayo Lobo, Cayo del Agua, Cayo Tiburon, and Cayos Geniqui are seven small cays that were identified by the ASR as part of the Culebra Island naval facility. Many of the cays were used for aerial bombardment with rockets and bombs. These cays have rugged terrain and limited beach areas. Most of the small cays are accessible only during calm seas and good weather. Access is currently restricted to FWS personnel or requires a special permit from FWS. The Action Memorandum recommended surface clearance as the remedial alternative for these cays.

### 1.4.2 Site History

1.4.2.01 United States Navy presence at Culebra Island began around 1901with the establishment of a base of operations in the town of San Idelfonso. The base, referred to as Lower Camp, was used to house Navy personnel and provide associated infrastructure. Over the years, the Navy constructed other facilities at Lower Camp, including a desalinization plant, barracks, helicopter pads, range instrumentation facilities, gun sites for the defense of the islands, observation points, and impact ranges for aerial bombs and rockets, missiles, mortars, and naval ordnance. Although the Navy temporarily abandoned the Lower Camp area between 1920 and 1942, the United States Caribbean fleet continued to use Culebra Island and the surrounding cays for naval exercises.

1.4.2.02 From the early 1900s through the late 1950s, the United States Marine Corps used Culebra for amphibious landings and ground maneuver training. The Marines landed at numerous locations on Culebra Island and the surrounding cays, established boat landings, set up camps, and conducted firing exercises on land targets and water targets.

1.4.2.03 The Navy conducted several large fleet exercises in the waters surrounding Culebra. One large fleet exercise was conducted from December 1923 through February 1924. Approximately 3,300 Marines armed with 155-millimeter (mm) guns, 75mm guns, and machine guns participated in the maneuvers. Another fleet exercise was documented from January through March 1935.

1.4.2.04 Use of Culebra and the surrounding cays as a bombing and gunnery range increased from 1935. After World War II, the North Atlantic Treaty Organization used the former Culebra Island naval facilities for joint training operations. The Navy also conducted submarine warfare maneuvers offshore of Culebra and the surrounding cays.

1.4.2.05 Until the early 1960s, Northwest Peninsula, Los Gemelos, and Alcarraza were the only aircraft targets in the complex. The Navy acquired additional training areas on cays east and west of Culebra Island for use as aircraft ranges to support increased training needs for Vietnam operations. Aerial mining was also conducted in the outlying cays, particularly around Cayo de Luis Peña. Live ordnance operations reached their peak in 1969, when the fleet was training pilots for Vietnam. Aircraft bombing and strafing ended in 1970, and the use of live rounds for naval gunfire support training ended in 1971. Subsequent naval support training was conducted using quarter puff rounds until all ordnance use was terminated on September 30, 1975.

### 1.4.3 MEC Hazards

Munitions of explosive concern (MEC) are safety hazards that may constitute an imminent danger to site personnel and the local population. During this surface removal action, it was necessary for EEG to demilitarize, by detonation on site, all MEC encountered. Because this work involved the removal and disposal of MEC, CEHNC prepared an explosives safety submittal for Cerro Balcon and the small cays that was approved by the Department of Defense Explosives Safety Board (DDESB) in February 2006.

## 1.5 Topography

1.5.01 Culebra Island has sandy beaches, an irregular rugged coastline, lagoons, coastal wetlands, steep mountains, and narrow valleys. Ninety percent of the island is hilly, and the level areas are primarily in the vicinity of the airport and the town center. The highest point on the island is Monte Resaca, approximately 630 feet above mean sea level. The summit of Cerro Balcon is approximately 550 feet above mean sea level. Most undeveloped areas are covered with moderately to extremely dense thorn scrub vegetation.

1.5.02 The island has a limited variety of soil types due to its volcanic origin, limited size, rugged terrain, and moderately uniform climate. Most soils, except along the slopes, are the result of weathering bedrock. The Desculabrado series is found on slopes of 20 to 40 percent and located over 75 percent of Culebra Island. The soils are well-drained, runoff is rapid, and permeability is moderate.

## 1.6 Geology

1.6.01 Soils on Culebra Island are predominately saprolite (weathered rock) and on average extend to a depth of approximately 4 feet. Igneous rock, predominantly comprised of andesite, underlies the saprolite. The top of Cerro Balcon contains an outcrop of metamorphosed slate that may be a remnant of the ancient sea floor prior to the eruption.

1.6.02 Areas adjacent to the hills and interior valleys contain alluvium eroded from the igneous rock and transported to the lower-lying areas by surface water runoff. Surface water runoff after severe rains collects in deep rills in the alluvium that are difficult to see through the vegetation and present a safety hazard. The rills reach depths of 4 feet.

1.6.03 The alluvium soils and rock on Culebra Island contain a high percentage of ferric minerals that could adversely impact the magnetic signatures of certain geophysical sensors, causing false positives.

## 1.7 Surface Water

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

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

## 1.8 Climate

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

## 1.9 Future Use

1.9.01 At the time of the 1995 EE/CA and 1997 Action Memorandum, it was believed that the future land use of the Cerro Balcon area would be for livestock grazing; however, construction of

houses atop the overlooking hills and surrounding areas has begun, and a new house has been completed immediately adjacent to the suspected former mortar range.

1.9.02 The cays surrounding Culebra would remain under the administration of FWS as part of the Culebra National Wildlife Refuge and would be legally accessibly only to FWS personnel or by special permit from FWS. Isla Culebrita would remain under the administration of the FWS as part of the Culebra National Wildlife Refuge and as an important recreational and natural resource to the local and tourist populations.

## 1.10 Site Utilities

No utilities were identified on any of the sites that were scoped under this removal action. The sites are remote, and only a few existing properties at Cerro Balcon have septic systems, water tanks, and electrical generators. In the future, encroaching housing construction may eventually bring utilities into the area.

## 1.11 Vegetation

Vegetation and wetlands surveys were conducted for sites located at Cerro Balcon, Cayo Lobo, and Isla Culebrita. Descriptions of the vegetation at the sites are summarized below.

### 1.11.1 Cerro Balcon

1.11.1.01 The vegetative association of the Cerro Balcon site is dry thorn-scrub forest. Most of the vegetation is found in the shrub layer, with some of the shrub species growing to small trees in size. Few of the trees are taller than 12 feet. The dominant plants are the sweet acacia (*Acacia farnsiana*), an invasive plant that provides the majority of cover, and guinea grass (*Urochloa maxima*), an introduced forage plant. Scattered throughout the acacia is mesquite (*Prosopis juliflora*), occurring as small trees growing larger and taller than the acacia.

1.11.1.02 Native shrub and tree species are present but are few in number. Puerto Rico box (*Buxus portoricensis*), an evergreen species, is the most common native shrub in the site vicinity but is much less common than acacia or mesquite. Fiddlewood (*Citharexylum fruticosum*), also an evergreen, grows taller than the surrounding vegetation and can be observed protruding from the acacia and mesquite. Also occurring with low frequency is the yellow prickle (*Zanthoxylum monophyllum*), which grows to 10 to 12 feet in height, normally with a single straight trunk identified by protruding short, knobby thorns. Fiddlewood and gumbo limbo (*Bursera simaruba*)

occur on the slope of Cerro Balcon. Surveys recorded no DNER critical elements or threatened or endangered species of plants.

1.11.1.03 Grasses are the predominant ground cover vegetation in areas that are not totally covered by shrubs. Native and introduced grasses include guinea grass (*Panicum maximum*), *Paspalum* species, and Bermuda grass (*Cynodon dactylon*), among others. Where the shrub cover is dense, ground cover vegetation is limited. Herbaceous plant species include cacti such as jumping cactus (*Opuntia repens*), prickly pear (*O. dillenii*), and Turk's head cactus (*Melocactus intortus*). Also found in the herbaceous layer are wild mallow (*Croton astroites*), wire weed (*Sida acuta*), Britton's wild petunia (*Ruellia Brittonii*), and passion flower (*Passiflora* sp.).

### 1.11.2 Cayo Lobo

Herbaceous vegetation dominates Cayo Lobo. Hurricane grass (*Bothriochloa pertusa*), an introduced species, covers more than 70 percent of the island. The grassland extends from the interior of the island up to the edges of the cliffs. On the western side of the cay, next to the helicopter pad, a small patch of *Leucaena leucocephala*, an invasive species, is starting to invade the grassy area. Most shrub and tree species occur on the edge of the cay and in the cliffs; however, woody vegetation is not continuous along the perimeter of the cay. Turk's cap cactus (*Melocactus intortus*) and a few patches of a hybrid seagrape (*Coccoloba krugii* x *C.uvifera*) growing on the cliffs and the edge of the plateau on the eastern part of the island are notable. Surveys recorded no DNER critical elements or threatened or endangered species of plants (ReForesta 2006a).

### 1.11.3 Isla Culebrita

1.11.3.01 Four distinct plant communities occur in northwestern Isla Culebrita: coastal forest, dry scrub forest, semi-open grasslands, and tidal flats (ReForesta 2006b):

1.11.3.02 Coastal forest consists of flat coastal areas with a closed tree canopy from 3.5 to 5 meters in height. The dominant tree species occurring in this community are button mangrove (*Conocarpus erectus*), sea grape (*Coccoloba uvifera*), water mampoo (*Pisonia subcordata*), and spoon tree (*Elaedendron xylocarpum*). The poisonous manchineel tree (*Hippomane mancinella*) occurs in these coastal thickets.

1.11.3.03 Dry scrub forest is the most abundant habitat type found in the study site. It occurs along the cliffs and hills of the island. The soil is rocky and very shallow. Canopy height averages

2.6 meters. The dominant shrubs and trees growing in this community are cat's claw (*Pithecellobium unguis-cati*), pipe-organ cactus (*Pilosocereus royenii*), crabwood (*Gymnanthes lucida*), and black willow (*Capparis cynophallophora*). The thorny bushy-vine *Oplonia spinosa* is also abundant.

1.11.3.04 Semi-open grasslands are grassy patches dominated by hurricane grass (*Bothriochloa pertusa*) and guineagrass (*Urochloa maxima*). Scattered cashia trees (*Acacia farnesiana*) and bushes (*Capparis flexuosa*) are common.

1.11.3.05 Tidal flats are seasonally flooded shallow lagoons. The lagoons may be partially or completely surrounded by mangrove forests dominated by white mangroves (*Laguncularia racemosa*) and black mangroves (*Avicennia germinans*).

## 1.12 Cultural Resources

Southeastern Archaeological Research, Inc., under contract to EEG, performed cultural resources surveys of the Cerro Balcon project site (SAR 2006a) and of the Isla Culebrita and Cayo Lobo project areas (SAR 2006b).

### 1.12.1 Cerro Balcon

1.12.1.01 Evidence of one prehistoric archaeological site was found within the access road on the southern edge of the Cerro Balcon main impact area. The site was disturbed and made visible because of the existing road to the site. About 12 small shards (each smaller than 3 square centimeters) were found on the road. Most were red or light brown body shards with a felsic paste, and one had a quartz paste. The only other location at which shards were found was the back dirt of an iguana burrow located 27 meters north of the road. All of the artifacts noted at this site appear to have been brought to the surface by modern disturbances to the soil.

1.12.1.02 Limited evidence was available to characterize the site. In essence, ceramics were recovered between two points located 200 feet (60 meters) apart. A few shells, other shards along the roadbed, and the split cobble on the road were found between the points. The site was overgrown by extremely dense vegetation, and slope wash (erosion) from the surrounding hills likely buried any prehistoric deposits. Without subsurface testing, the extent and nature of this site could not be determined.

1.12.1.03 As the removal action was surface clearance only and did not include any subsurface impacts to the area of the archaeological site, the removal action did not adversely affect this area. Puerto Rico State Historic Preservation Office archaeological site file forms were completed and submitted for this one resource.

### 1.12.2 Cayo Lobo and Isla Culebrita

Walkover surveys at the Isla Culebrita and Cayo Lobo project areas revealed no cultural resources and no evidence of past resource exploitation. Neither Cayo Lobo nor Isla Culebrita offered any signs of historic or prehistoric activities, nor were any historic structures located within the project areas.

# 2.0 MEC Investigation and Removal

2.0.01 The approach, methods, and operational procedures to perform all surface clearance of MEC on Culebra Island and adjacent cays were detailed in the work plan, the task order scope of work, and applicable reference and guidance documents. Any significant deviations from the work plan were instituted only following approval of field change requests from CEHNC.

2.0.02 The work plan documents were approved in March 2006, and notice to proceed with the removal action was received from USACE on April 4, 2006. Munitions removal operations began the week of May 22, 2006. No site work was conducted during a holiday break from December 18, 2006, through January 6, 2007. Daily reports prepared by the senior UXO supervisor (SUXOS) are included in **Appendix C**.

2.0.03 Demobilization began on April 15, 2007, when no additional funds were available to complete the project.

## 2.1 Field Change Requests

Eight field changes were requested by EEG during the field effort. These were submitted to CEHNC along with revision pages to the work plan. All field change requests approved by CEHNC during this field effort are included in **Appendix D**.

## 2.2 Site Accessibility and Impediments

### 2.2.1 Cerro Balcon

2.2.1.01 Roads were cleared and widened to improve access to the Cerro Balcon site and the explosives storage magazine. When heavy rains occurred, dirt/clay roads on Culebra became slick and increased the possibility of vehicles getting stuck or sliding off the roadway. At Cerro Bacon, the site was inaccessible on several occasions when roads were so slippery that even 4-wheel-drive vehicles could not safely access the site.

2.2.1.02 Work sites located on the extreme slopes of Cerro Balcon were difficult to access due to their steepness, rilling, and thorny vegetation. The slopes were too steep for vegetation clearance using heavy equipment and would have required clearance by hand. The UXO quality control / safety officer (UXOQC/SO) and the CEHNC representative agreed that fall protection and appropriate training would be necessary for work on grids in those sites. Because EEG was

not able to secure proper training, those grids were not cleared. Also, when right of entry was denied on one of the main properties located at Cerro Balcon, it was replaced with a different area to the south of the original grid.

### 2.2.2 Cayo Lobo

2.2.2.01 Due to currents and continual wave action, Cayo Lobo has only a single protected access point, which is located in a small cove at the center of the southwestern side of the island. A very shallow draft boat was necessary for safe landing due to the shallow reefs and rocks at the landing area. All equipment was carried into the work areas by foot because mechanical equipment was not allowed on the cay.

2.2.2.02 Cayo Lobo is located approximately 2.5 nautical miles west of Culebra Island. The cay covers 28 acres and is surrounded by rocky cliffs of volcanic origin. It is comprised of three distinct promontories interconnected by a lower "saddle" ridge. Terrain is generally sloping with mild to moderate grades. A thick vegetative cover almost 2 feet in height masks most of the surface, making walking to the site and investigating anomalies at the ground surface difficult. The surface of the cay is strewn with large boulders and loose rocks beneath vegetation. Several large depressions are located in the central plain of the island.

2.2.2.03 Cayo Lobo was accessible only during favorable surf conditions. EEG personnel monitored the weather conditions every day. On days when the swells were too high, the team immediately moved to Cerro Balcon. On days that were marginal, a small boat was used to verify the conditions. North swells, prevalent during the fall and winter, precluded access to Cayo Lobo on more than 29 work days between September 11, 2006, and April 12, 2007 (the equivalent of slightly more than seven work weeks). The 29 days that were lost due to high swells include days on which EEG believed that landing was possible but proved not to be on arrival at the cay. On those days, the team would return to Culebra Island to finish the day working on Cerro Balcon. Due to these delays, additional funding would have been required to complete the work at the cays. Because of the type of contract that EEG had, the contracting officer could not add funding to complete the work.

### 2.2.3 Isla Culebrita

The only operations conducted on Isla Culebrita were the ecological and archaeological surveys. Isla Culebrita would be accessible in most weather conditions, as the main beach is protected

from current and wave action and several access points are available. MEC operations were not conducted at Isla Culebrita because the DDESB review of the explosives safety submittal was not completed until the end of the field work and insufficient time remained to change operations.

## 2.3 Explosives Control and Accountability

2.3.01 EEG constructed a magazine security compound in accordance with Puerto Rico police explosives management requirements. The magazine consisted of a 4-by-4-foot Type II magazine with a 16-inch-square cap box attached. The magazine was surrounded by a 10-foot-tall fence with barbed wire at the top.

2.3.02 The Puerto Rico police required full-time security of the explosives magazine when it contained explosives. EEG hired off-duty police and other security personnel to maintain security of the explosives.

2.3.03 Following receipt of explosives and validation, a magazine data card was completed for each type of explosive stored at the project site. Whenever explosive stocks were re-supplied, inventoried, or issued, the action was noted in the appropriate block(s) of the card. The SUXOS and the UXOQC/SO inventoried all of the material on the data card on a weekly basis.

2.3.04 Unused "daily issued" explosives were returned to the magazine. Explosives were returned in their original containers. The quantities were indicated on the magazine card, and the receipt document was annotated to indicate the types and quantities of explosives returned to storage.

2.3.05 During the holiday break, the explosives inventory was transferred to and stored by the Federal Bureau of Investigation (FBI). Following completion of field operations in April 2007, the remaining explosives inventory was transferred to the FBI.

## 2.4 Major Stages of Work

The scope of work was completed in the following stages:

- Pre-field activities
- Site preparation
- Identification, segregation, and removal of material potentially presenting an explosive hazard (MPPEH)
- Management and disposal of munitions debris

- Quality assurance (QA) and quality control (QC)

### 2.4.1 Pre-Field Activities

Pre-field activities included:

- Attending technical project planning meetings and community involvement meetings
- Visiting the site in April 2005 along with representatives of USACE, FWS, DNER, and EQB
- Assisting with a presentation at a public meeting held in Culebra on February 9, 2006
- Preparing and obtaining approval of site-specific work plans

### 2.4.2 Site Preparation

The field preparation crew consisting of a site manager, an ecologist, an archaeologist, and a UXO Technician II mobilized to Culebra on April 18, 2006. Initial site preparations were completed on May 19, 2006, and included:

- Conducting ecological and archaeological surveys of the Cerro Balcon site
- Acquiring concurrence from DNER for vegetation removal at Cerro Balcon
- Acquiring concurrence from USACE cultural resources specialist that no significant archaeological resources would be disturbed by surface removal operations at Cerro Balcon
- Clearing an access route to and constructing an explosives magazine storage area
- Acquiring acceptance of the compound by the Puerto Rico State Police Division of Explosives and Security after inspection
- Locating Cerro Balcon grid corners (performed by a Puerto Rico licensed surveyor)
- Acquiring Puerto Rico explosives licenses for key UXO personnel
- Setting up office and storage areas in the town of Dewey
- Removing vegetation
- Providing support for a public information meeting held on Culebra on May 17, 2006

#### 2.4.2.1 Grid Corner Location Survey

2.4.2.1.01 Grid corners and control points were surveyed during two discrete efforts at Cerro Balcon. EEG provided grid corner coordinates to subcontractor Renan Lopez de Azua and Associates (a Puerto Rico licensed surveyor) to locate and mark grid corners for the investigation. Subsequent location surveys were conducted at Cerro Balcon and Cayo Lobo in April 2007 by

Geoboundaries, Inc. (also a Puerto Rico licensed surveyor). Data collected from these surveys are included in **Appendix E.**

2.4.2.1.02 The coordinate system was dictated by CESAJ and CEHNC to be consistent with the supplied base map. Coordinates were in the Universal Transverse Mercator (UTM) Zone 19 projection using the North American Datum (NAD) of 1927 (Puerto Rico). Unit of measure was feet (1 foot = approximately 0.3048006096012192 meters).

2.4.2.1.03 The work plan provided for use of 200-by-200-foot grids for the investigation. A field change request was allowed to give the SUXOS control to subdivide each grid. The overall grid structures were maintained.

#### 2.4.2.2 Vegetation Clearance

2.4.2.2.01 Vegetation clearance operations were conducted in accordance with the work plan and began on May 22, 2006, at the Cerro Balcon site. Timberline Environmental Services, Inc. (TES) was contracted to assist with the vegetation clearance using a Tractor Accessorized Zerriest Series II (TAZ II) to clear brush on the site (see **Appendix F**, Photo 1). The TAZ was able to cut the 6-to-8-foot-tall mesquite vegetation into a 2-foot-thick ground cover. It also was able to make the thorns easier to navigate but did not completely remove the potential for puncture by the thorns.

2.4.2.2.02 When the TAZ was operating at full potential, approximately one acre per day was cleared of vegetation. The TAZ was utilized on site until July 5, 2006, at which time approximately 19 acres had been cleared of vegetation in 20.5 work days. The TAZ was not able to maneuver up the steep side slopes on the east side at Cerro Balcon. TES demobilized from Culebra on July 7, 2006.

2.4.2.2.03 EEG personnel performed principally close clearing around native trees that were designated for preservation (see **Appendix F**, Photo 2). Native trees occurred primarily on the slope of Cerro Balcon. EEG personnel also used steel-bladed brush cutters, chain saws, and hand tools to remove the dense vegetation in the work grids at Cerro Balcon and Cayo Lobo.

2.4.2.2.04 EEG personnel used only hand tools (clippers and weed trimmers) to prune the vegetation at Cayo Lobo. Most of the vegetation was 2 to 3 feet tall and was a hindrance to walking through the site; however, minimal amount of vegetation pruning was required. A few sparsely located stands of mesquite are found on Cayo Lobo.

### 2.4.3 Identification, Segregation, and Removal of MPPEH

2.4.3.01 The project involved identification, segregation, and removal of MPPEH. The MPPEH included munitions containers and packaging material; munitions debris remaining after munitions use, demilitarization, or disposal; and range-related debris; or material potentially contaminated with a high enough concentration of explosives such that the material presented an explosive hazard.

2.4.3.02 The work was conducted in accordance with the Final Work Plan (EEG 2006) and the approved field change requests. During field operations, the SUXOS prepared daily reports of the site activities, and the data from those reports and a database prepared on site are the basis for this site-specific report.

2.4.3.03 After the grid boundaries were reacquired, sweep lanes 4 feet wide were roped off in a pattern that allowed UXO personnel optimum sweep rates. Each grid or subgrid was searched and subject to its own QC and QA approvals.

2.4.3.04 EEG used both magnetic and electromagnetic means of locating MPPEH. Use of a White's XLT metal detector was initially scoped for this project but the White's was impacted in areas of thick vegetative debris that remained after the TAZ had cut down the vegetation. A Schonstedt GA-52 CX flux gate magnetometer was used instead at many areas of the site because it was quicker to work with the false anomalies than it was to slow down the search pattern to ensure that items were found. The number of subsurface anomalies was recorded at each grid to assist with future site planning.

2.4.3.05 Qualified UXO-trained personnel investigated and identified all MPPEH and further classified it into munitions constituents. The MEC posed a safety threat and were safely rendered inert by explosive means within each grid. All demilling detonations were conducted within the grid or subgrid in which the MEC were located. Surface MEC item location coordinates were determined by global positioning system (GPS). Detonation locations, if different than MEC item locations, were determined by GPS. Any remaining munitions debris was declared inert and was certified as such prior to removal from the grid. The munitions debris was later transported from the site and disposed of by incineration.

2.4.3.06 EEG used a Trimble ProXR GPS unit to collect real-time corrected positional data. The correction signal was transmitted from the Isabela continuously operating reference station (CORS) site (reference identification PUR5) located on the northwest coast of Puerto Rico.

2.4.3.07 During field operations at Cayo Lobo, the Isabela reference station went offline several times. In those cases, locations for demolition operations were collected in the field as uncorrected positions, which were then post-processed in the office using CORS San Juan WAAS (reference identification ZSU1) located at Luis Muñoz Marin International Airport, or CORS St. Thomas (reference identification VITH) located in the United States Virgin Islands.

2.4.3.08 Once all MEC was destroyed and munitions debris was removed from the grids, the CEHNC site safety representative checked 10 percent of the grids as a QC check. Copies of the individual signed Form 948s documenting acceptance of the respective grids are included in **Appendix G.**

#### 2.4.3.1 MPPEH Locations at Cerro Balcon

2.4.3.1.01 Surface clearance sweeps at Cerro Balcon began on June 8, 2006, and were completed on April 2, 2007. Surface sweep grids at 200 by 200 feet were originally laid out and surveyed as described and depicted in the work plan, with the exception of the grids across the fence line to which no right-of-entry permission was obtained. In accordance with a field change request, EEG subdivided certain grids based on topographic, vegetative, and other logistical constraints. The corners of the resulting subgrids were located using a Trimble ProXR GPS. Each subgrid was identified by the letter a, b, c, or d, starting with the subgrid in the southwest quarter of the main grid and going clockwise around the gird. **Figure B2 (Appendix B)** shows the Cerro Balcon grid layout and grid designations.

2.4.3.1.02 Grids E04 and F05 were each subdivided into two subgrids. The westernmost subgrids, designated E04b and E05b, were located on the lower slope of Cerro Balcon and were swept. The upslope subgrids (E04a and E05a) were determined by the UXOQC/SO and SUXOS to be too steep for safe operations. Grids D01, D02, D03, E01, E02, and E03 were also determined by the UXOQC/SO and SUXOS to be too steep (slopes were greater than 40 percent and up to 60 percent) to permit safe clearance of vegetation or MEC sweeps without the use of safety climbing gear and proper training on the use of that gear.

2.4.3.1.03 In lieu of steep grids and grids for which right of entry was not granted by the landowner, additional 200-by-200-foot grids were established in the southwestern portion of the Cerro Balcon site. Those grids were designated A07, B07, ZZ04-07, and YY04-07. During sweep operations, each of those grids was subdivided as described above.

2.4.3.1.04 Additionally, an approximately 200-by-200-foot grid was added and investigated on private property on the southern flank of Cerro Balcon, just east of the original project area. This grid was added as a result of the CEHNC on-site representative finding a 3-inch common round adjacent to the Cerro Balcon site access road. The round was likely uncovered when the landowner recently cleared the property of vegetation. This grid was designated CBH08 and subdivided as described above.

#### *2.4.3.1.1 Grids Completed at Cerro Balcon*

A total of 46 separate grids or subgrids were swept for MEC at Cerro Balcon as listed in **Table 2-1**. Total area cleared was approximately 23.9 acres (based on map projection areas).

**Table 2-1. Cerro Balcon Grids Completed**

| Parent Grid | OE Grid ID | Date Cleared | QC Date | QA Date | Grid Area (acres) |
|---|---|---|---|---|---|
| CBA05 | CBA05 | 2006-06-14 | 2006-06-14 | 2006-06-14 | 0.93 |
| CBA06 | CBA06 | 2006-06-19 | 2006-06-19 | 2006-06-20 | 0.93 |
| CBA04 | CBA04 | 2006-06-19 | 2006-06-22 | 2006-06-23 | 0.93 |
| CBA03 | CBA03 | 2006-06-22 | 2006-06-22 | 2006-06-23 | 0.93 |
| CBB03 | CBB03 | 2006-06-22 | 2006-06-22 | 2006-06-23 | 0.93 |
| CBC03 | CBC03 | 2006-06-22 | 2006-06-22 | 2006-06-23 | 0.93 |
| CBD06 | CBD06 | 2006-06-23 | 2006-06-26 | 2006-06-27 | 0.93 |
| CBF06 | CBF06 | 2006-06-26 | 2006-06-27 | 2006-06-27 | 0.93 |
| CBE06 | CBE06 | 2006-06-27 | 2006-06-27 | 2006-06-27 | 0.93 |
| CBC06 | CBC06 | 2006-06-28 | 2006-06-29 | 2006-06-29 | 0.93 |
| CBB06 | CBB06 | 2006-06-29 | 2006-07-03 | 2006-07-03 | 0.93 |
| CBB05 | CBB05 | 2006-07-03 | 2006-07-06 | 2006-07-11 | .093 |
| CBE04 | CBE04b | 2006-07-12 | 2006-07-12 | 2006-07-13 | 0.47 |
| CBC05 | CBC05 | 2006-07-12 | 2006-07-18 | 2006-07-19 | 0.93 |
| CBD05 | CBD05 | 2006-07-19 | 2006-07-19 | 2006-07-19 | 0.93 |
| CBD04 | CBD04 | 2006-07-20 | 2006-07-24 | 2006-07-26 | 0.93 |
| CBC04 | CBC04 | 2006-07-26 | 2006-08-07 | 2006-08-07 | 0.93 |
| CBE05 | CBE05 | 2006-07-26 | 2006-07-26 | 2006-08-07 | 0.93 |

| Parent Grid | OE Grid ID | Date Cleared | QC Date | QA Date | Grid Area (acres) |
|---|---|---|---|---|---|
| CBB04 | CBB04 | 2006-08-02 | 2006-08-02 | 2006-08-07 | 0.93 |
| CBF05 | CBF05b | 2006-08-02 | 2006-08-07 | 2006-08-07 | 0.47 |
| CBZZ04 | CBZZ04 | 2006-09-05 | 2006-09-05 | 2006-09-07 | 0.93 |
| CBZZ05 | CBZZ05 | 2006-10-16 | 2006-10-16 | 2007-01-10 | 0.93 |
| CBZZ06 | CBZZ06a | 2007-01-15 | 2007-01-15 | 2007-01-16 | 0.24 |
| CBZZ06 | CBZZ06b | 2007-01-15 | 2007-01-15 | 2007-01-16 | 0.22 |
| CBZZ06 | CBZZ06c | 2007-01-15 | 2007-01-15 | 2007-01-16 | 0.20 |
| CBZZ06 | CBZZ06d | 2007-01-15 | 2007-01-15 | 2007-01-16 | 0.21 |
| CBZZ07 | CBZZ07c | 2007-01-17 | 2007-01-25 | 2007-01-25 | 0.22 |
| CBZZ07 | CBZZ07b | 2007-01-23 | 2007-01-25 | 2007-01-25 | 0.20 |
| CBZZ07 | CBZZ07d | 2007-01-23 | 2007-01-25 | 2007-01-25 | 0.25 |
| CBZZ07 | CBZZ07a | 2007-01-25 | 2007-01-25 | 2007-01-25 | 0.23 |
| CBA07 | CBA07b | 2007-01-29 | 2007-02-01 | 2007-02-12 | 0.20 |
| CBA07 | CBA07a | 2007-01-30 | 2007-02-01 | 2007-02-12 | 0.23 |
| CBA07 | CBA07d | 2007-01-31 | 2007-02-01 | 2007-02-12 | 0.25 |
| CBA07 | CBA07c | 2007-02-09 | 2007-02-09 | 2007-02-12 | 0.21 |
| CBH08 | CBH08a | 2007-02-12 | 2007-02-12 | 2007-02-15 | 0.20 |
| CBH08 | CBH08b | 2007-02-12 | 2007-02-12 | 2007-02-15 | 0.19 |
| CBH08 | CBH08c | 2007-02-12 | 2007-02-12 | 2007-02-15 | 0.19 |
| CBH08 | CBH08d | 2007-02-12 | 2007-02-12 | 2007-02-15 | 0.19 |
| CBYY07 | CBYY07d | 2007-02-22 | 2007-02-22 | 2007-03-08 | 0.21 |
| CBYY07 | CBYY07a | 2007-02-26 | 2007-02-26 | 2007-03-08 | 0.21 |
| CBYY07 | CBYY07b | 2007-02-27 | 2007-03-08 | 2007-03-08 | 0.20 |
| CBYY07 | CBYY07c | 2007-03-14 | 2007-03-14 | 2007-03-15 | 0.22 |
| CBYY06 | CBYY06d | 2007-03-15 | 2007-03-29 | 2007-03-29 | 0.26 |
| CBYY06 | CBYY06c | 2007-03-29 | 2007-03-30 | 2007-03-30 | 0.24 |
| CBYY06 | CBYY06b | 2007-03-30 | 2007-04-02 | 2007-04-03 | 0.24 |
| CBYY06 | CBYY06a | 2007-04-02 | 2007-04-10 | 2007-04-10 | 0.21 |

#### *2.4.3.1.2 MEC Items at Cerro Balcon*

2.4.3.1.2.01 Ten MEC items were located in the Cerro Balcon search area, including two fuzes, five projectiles, and three mortars. **Table 2-2** identifies the MEC items found and indicates whether they were blown in place or moved to a detonation location. **Figure B3 (Appendix B)** shows the locations of the MEC items. Detonation locations are depicted in **Figure B4 (Appendix B)**, and listed in **Table 2-3**. Photos of MEC items are in **Appendix H**.

**Table 2-2. MEC Items Located and Demilled at Cerro Balcon**

| OE Grid ID | Demo Op ID | Date Found | Demo Date | MEC ID | Item Name | Type | Filler | Fuze | BIP |
|---|---|---|---|---|---|---|---|---|---|
| CBB05 | CB001 | 2006-07-03 | 2006-07-06 | CBB05001 | 3-inch common MK3 MOD7 | Projectile | Empty | None | X |
| CBB05 | CB001 | 2006-07-03 | 2006-07-06 | CBB05002 | Model 1898 15-second PTTF | Fuze | Unknown, probably black powder | -- | |
| CBC05 | CB002 | 2006-07-12 | 2006-07-13 | CBC05001 | Model 1898 15-second PTTF | Fuze | Unknown, probably black powder | -- | X |
| CBD04 | CB003 | 2006-07-17 | 2006-07-20 | CBD04002 | 3-inch common MK3 MOD7 | Projectile | TNT | MK2 BD | X |
| CBD04 | CB004 | 2006-07-17 | 2006-07-20 | CBD04001 | 3-inch common MK3 MOD7 | Projectile | TNT | MK2 BD | X |
| CBD04 | CB004 | 2006-07-17 | 2006-07-20 | CBD04003 | 81mm M43 | Mortar | Comp B | None | |
| CBC04 | CB005 | 2006-07-26 | 2006-08-07 | CBC04001 | 81mm M43 | Mortar | Comp B | None | |
| CBZZ07c | CB006 | 2007-01-17 | 2007-01-22 | CBZZ07c001 | MK14 | Projectile | Inert | -- | X |
| CBH08d | CB007 | 2006-09-19 | 2007-01-22 | CBH08001 | 3-inch common MK3 MOD7 | Projectile | Inert | -- | X |
| CBYY05c | CB008 | 2007-02-20 | 2007-02-22 | CBYY05c001 | 4.2-inch mortar | Mortar | Empty, possible live burster | Point detonating | X |
| BIP = Blown in place | | | | | | | | | |

**Table 2-3. Cerro Balcon Demolition Operations**

| Demo Op ID | Demo Date | Demo Time | All Clear Time | Easting | Northing |
|---|---|---|---|---|---|
| CB001 | 2006-07-06 | 10:42:00 a.m. | 10:47:00 a.m. | 2934472.423 | 6657555.920 |
| CB002 | 2006-07-13 | 09:40:00 a.m. | 09:45:00 a.m. | 2934732.519 | 6657496.934 |
| CB003 | 2006-07-20 | 12:28:00 p.m. | 12:40:00 p.m. | 2934928.806 | 6657766.345 |
| CB004 | 2006-07-20 | 12:28:00 p.m. | 12:40:00 p.m. | 2934928.801 | 6657702.511 |
| CB005 | 2006-08-07 | 09:16:00 a.m. | 09:24:00 a.m. | 2934747.997 | 6657611.521 |
| CB006 | 2007-01-22 | 11:16:00 a.m. | 11:30:00 a.m. | 2934185.449 | 6657093.891 |
| CB007 | 2007-01-22 | 11:16:00 a.m. | 11:30:00 a.m. | 2935599.851 | 6656809.805 |
| CB008 | 2007-02-22 | 09:52:00 a.m. | 10:02:00 a.m. | 2933885.358 | 6657455.406 |

2.4.3.1.2.02 All demolition shots were sand-bagged to reduce the possibility of fire and fragmentation dispersal, and for sound attenuation. EEG also used water jugs on most shots and pools on some of the shots. To reduce the potential for grass fires, a hose from a water truck was

used during dry periods to wet down the vegetation before demolition operations. The SUXOS and the UXOQC/SO witnessed the destruction of all UXO and explosive material.

2.4.3.1.2.03 A total of 8,802 subsurface anomalies were counted at the Cerro Balcon project site. Most were believed to result from the mineralzed soil and rock at the site. Since no subsurface excavations were performed, the sources of the anomalies were undetermined.

#### 2.4.3.2 MPPEH Locations at Cayo Lobo

Cayo Lobo clearance operations began on September 11, 2006, and were completed on April 12, 2007, after concurrence with the environmental and cultural resources reports. Surface sweep grids at 200 by 200 feet were established, and EEG subdivided certain grids based on topographic, vegetative, and other logistical constraints. The corners of the resulting subgrids were located using a Trimble ProXR GPS. Each subgrid was identified by the letter a, b, c, or d, starting with the subgrid in the southwest corner of the main grid and going clockwise around the grid. After the boundaries were marked, 4-foot-wide search lanes were established. **Figure B5 (Appendix B)** shows the Cayo Lobo grid layout and grid designations.

##### *2.4.3.2.1 Grids Completed at Cayo Lobo*

A total of 48 separate grids or subgrids were swept for MEC at Cayo Lobo as listed in **Table 2-4**. Total area cleared was approximately 11.2 acres (based on map projection areas).

**Table 2-4. Cayo Lobo Grids Completed**

| Parent Grid | OE Grid ID | Date Cleared | QC Date | QA Date | Grid Area (acres) |
|---|---|---|---|---|---|
| CLA07 | CLA07 | 2007-03-20 | 2007-03-26 | 2007-03-26 | 0.11 |
| CLB05 | CLB05 | 2007-03-05 | 2007-03-06 | 2007-03-06 | 0.27 |
| CLB06 | CLB06 | 2007-02-28 | 2007-03-01 | 2007-03-05 | 0.21 |
| CLB07 | CLB07a | 2006-11-02 | 2006-11-16 | 2006-12-06 | 0.14 |
| CLB07 | CLB07b | 2006-11-01 | 2006-11-20 | 2006-12-06 | 0.21 |
| CLB07 | CLB07c | 2006-11-01 | 2006-11-16 | 2006-12-06 | 0.27 |
| CLB08 | CLB08 | 2006-10-17 | 2006-10-17 | 2006-12-06 | 0.78 |
| CLC05 | CLC05a | 2007-04-11 | 2007-04-11 | 2007-04-12 | 0.23 |
| CLC05 | CLC05b | 2007-04-04 | 2007-04-04 | 2007-04-12 | 0.23 |
| CLC05 | CLC05c | 2007-04-09 | 2007-04-11 | 2007-04-12 | 0.23 |
| CLC05 | CLC05d | 2007-04-11 | 2007-04-12 | 2007-04-12 | 0.23 |
| CLC06 | CLC06a | 2007-03-06 | 2007-03-07 | 2007-03-07 | 0.23 |

| Parent Grid | OE Grid ID | Date Cleared | QC Date | QA Date | Grid Area (acres) |
|---|---|---|---|---|---|
| CLC06 | CLC06b | 2007-03-06 | 2007-03-07 | 2007-03-07 | 0.23 |
| CLC07 | CLC07a | 2006-11-20 | 2006-11-21 | 2006-12-06 | 0.23 |
| CLC07 | CLC07b | 2006-11-21 | 2006-12-06 | 2006-12-06 | 0.23 |
| CLC07 | CLC07c | 2006-11-27 | 2006-11-27 | 2006-12-06 | 0.23 |
| CLC07 | CLC07d | 2006-11-21 | 2006-11-27 | 2006-12-06 | 0.23 |
| CLC08 | CLC08 | 2006-10-24 | 2006-10-24 | 2006-12-06 | 0.91 |
| CLD05 | CLD05 | 2007-03-27 | 2007-04-03 | 2007-04-03 | 0.32 |
| CLD06 | CLD06a | 2007-03-07 | 2007-03-07 | 2007-03-07 | 0.15 |
| CLD06 | CLD06b | 2007-03-07 | 2007-03-07 | 2007-03-07 | 0.19 |
| CLD06 | CLD06c | 2007-04-09 | 2007-04-11 | 2007-04-12 | 0.22 |
| CLD06 | CLD06d | 2007-04-09 | 2007-04-11 | 2007-04-12 | 0.22 |
| CLD07 | CLD07a | 2006-11-21 | 2006-12-06 | 2006-12-06 | 0.23 |
| CLD07 | CLD07b | 2006-11-27 | 2006-12-07 | 2006-12-07 | 0.23 |
| CLD07 | CLD07c | 2006-11-21 | 2006-11-27 | 2006-12-06 | 0.23 |
| CLD07 | CLD07d | 2006-11-20 | 2006-11-27 | 2006-12-06 | 0.23 |
| CLD08 | CLD08a | 2006-10-24 | 2006-10-24 | 2006-12-06 | 0.23 |
| CLD08 | CLD08b | 2006-10-30 | 2006-11-16 | 2006-12-06 | 0.25 |
| CLD08 | CLD08c | 2006-10-24 | 2006-10-24 | 2006-12-06 | 0.23 |
| CLD08 | CLD08d | 2006-10-30 | 2006-11-16 | 2006-12-06 | 0.23 |
| CLE06 | CLE06b | 2007-04-09 | 2007-04-11 | 2007-04-13 | 0.11 |
| CLE06 | CLE06c | 2007-04-03 | 2007-04-05 | 2007-04-09 | 0.19 |
| CLE06 | CLE06d | 2007-04-09 | 2007-04-11 | 2007-04-12 | 0.22 |
| CLE07 | CLE07a | 2007-02-07 | 2007-02-15 | 2007-02-28 | 0.22 |
| CLE07 | CLE07b | 2007-02-13 | 2007-02-15 | 2007-02-28 | 0.24 |
| CLE07 | CLE07c | 2007-02-13 | 2007-02-15 | 2007-02-28 | 0.24 |
| CLE07 | CLE07d | 2007-02-07 | 2007-02-15 | 2007-02-28 | 0.23 |
| CLE08 | CLE08a | 2007-03-20 | 2007-03-20 | 2007-03-26 | 0.16 |
| CLE08 | CLE08b | 2007-03-20 | 2007-04-05 | 2007-04-09 | 0.08 |
| CLF06 | CLF06a | 2007-03-27 | 2007-03-27 | 2007-04-12 | 0.08 |
| CLF06 | CLF06c | 2007-03-26 | 2007-03-27 | 2007-04-12 | 0.13 |
| CLF06 | CLF06d | 2007-03-26 | 2007-04-05 | 2007-04-09 | 0.16 |
| CLF07 | CLF07a | 2007-02-28 | 2007-03-01 | 2007-03-05 | 0.23 |
| CLF07 | CLF07b | 2007-03-05 | 2007-03-05 | 2007-03-05 | 0.24 |
| CLF07 | CLF07c | 2007-03-05 | 2007-03-06 | 2007-03-06 | 0.21 |
| CLF07 | CLF07d | 2007-03-06 | 2007-03-06 | 2007-03-06 | 0.19 |
| CLF08 | CLF08 | 2007-03-19 | 2007-03-20 | 2007-03-26 | 0.07 |

#### 2.4.3.2.2 MEC Items at Cayo Lobo

2.4.3.2.2.01 A total of 48 MEC items were located in the Cayo Lobo search area, of which 41 were BDU33 25-pound practice bombs. Additional MEC included one BDU33 signal cartridge, four MK106 5-pound practice bombs, one M151 fuze, and one 5-inch 54 MK41 projectile. **Table 2-5** identifies the MEC items found and indicates whether they were blown in place or moved to a detonation location. **Figure B6 (Appendix B)** shows the locations of the MEC items. The 18 detonation locations on Cayo Lobo are depicted in **Figure B7 (Appendix B)**, and listed in **Table 2-6**. For safety purposes, detonations were conducted using a remote firing device. Photos of MEC items are in **Appendix H**.

**Table 2-5. MEC Items Located and Demilled at Cayo Lobo**

| OE Grid ID | Demo Op ID | Date Found | Demo Date | MEC ID | Item Name | Type | Filler | Fuze | BIP |
|---|---|---|---|---|---|---|---|---|---|
| CLB08 | CL001 | 2006-09-12 | 2006-09-26 | CLB08001 | M151 | Fuze | Unknown | N/A | X |
| CLB08 | CL001 | 2006-09-20 | 2006-09-26 | CLB08002 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLB08 | CL001 | 2006-09-20 | 2006-09-26 | CLB08003 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLB07a | CL002 | 2006-09-26 | 2006-09-27 | CLB07002 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | X |
| CLB08 | CL003 | 2006-10-02 | 2006-10-02 | CLB08004 | MK106 | Bomb, practice, 5-lb | Spotting charge | Striker | X |
| CLB08 | CL003 | 2006-10-02 | 2006-10-02 | CLB08005 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL004 | 2006-10-02 | 2006-10-02 | CLC08001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | X |
| CLC08 | CL005 | 2006-10-03 | 2006-10-03 | CLC08002 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL005 | 2006-10-03 | 2006-10-03 | CLC08003 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL005 | 2006-10-03 | 2006-10-03 | CLC08004 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-09 | 2006-10-12 | CLC08005 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-09 | 2006-10-12 | CLC08006 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-09 | 2006-10-12 | CLC08007 | MK106 | bomb,practice-5-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-10 | 2006-10-12 | CLC08008 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-10 | 2006-10-12 | CLC08009 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |

| OE Grid ID | Demo Op ID | Date Found | Demo Date | MEC ID | Item Name | Type | Filler | Fuze | BIP |
|---|---|---|---|---|---|---|---|---|---|
| CLC08 | CL006 | 2006-10-10 | 2006-10-12 | CLC08010 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-10 | 2006-10-12 | CLC08011 | MK106 | Bomb, practice, 5-lb | Spotting charge | Striker | X |
| CLC08 | CL006 | 2006-10-10 | 2006-10-12 | CLC08012 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-10 | 2006-10-12 | CLC08013 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-10 | 2006-10-12 | CLC08014 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-11 | 2006-10-12 | CLC08015 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-11 | 2006-10-12 | CLC08016 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC08 | CL006 | 2006-10-11 | 2006-10-12 | CLC08017 | MK106 | Bomb, practice, 5-lb | Spotting charge | Striker | |
| CLB08 | CL007 | 2006-10-09 | 2006-10-12 | CLB08006 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | X |
| CLB08 | CL007 | 2006-10-09 | 2006-10-12 | CLB08007 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLD08a | CL008 | 2006-10-17 | 2006-10-23 | CLD08a001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | X |
| CLD08a | CL008 | 2006-10-17 | 2006-10-23 | CLD08a002 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLD08b | CL009 | 2006-10-30 | 2006-11-02 | CLD08b001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLD08b | CL009 | 2006-10-30 | 2006-11-02 | CLD08b002 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLD08b | CL009 | 2006-10-30 | 2006-11-02 | CLD08b003 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLD08d | CL009 | 2006-11-01 | 2006-11-02 | CLD08d001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLB07a | CL010 | 2006-11-01 | 2006-11-02 | CLB07a001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | X |
| CLB07c | CL011 | 2006-11-01 | 2006-11-02 | CLB07c001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLB07c | CL011 | 2006-10-31 | 2006-11-02 | CLB07c002 | 5-inch 54 MK41 | Projectile | Explosive D | M500 series nose fuze PD | X |
| CLD07d | CL012 | 2006-11-20 | 2006-11-22 | CLD07d001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | X |
| CLD07d | CL012 | 2006-11-20 | 2006-11-22 | CLD07d002 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLD07d | CL012 | 2006-11-20 | 2006-11-22 | CLD07d003 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |

| OE Grid ID | Demo Op ID | Date Found | Demo Date | MEC ID | Item Name | Type | Filler | Fuze | BIP |
|---|---|---|---|---|---|---|---|---|---|
| CLD07b | CL013 | 2006-11-27 | 2006-12-07 | CLD07b001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLD07b | CL013 | 2006-11-27 | 2006-12-07 | CLD07b002 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | X |
| CLE07c | CL014 | 2007-02-06 | 2007-02-14 | CLE07c001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | X |
| CLE07c | CL014 | 2007-02-13 | 2007-02-14 | CLE07c002 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLE07c | CL014 | 2007-02-13 | 2007-02-14 | CLE07c003 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLF07b | CL015 | 2007-03-01 | 2007-03-13 | CLF07b001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLE08b | CL016 | 2007-03-20 | 2007-04-05 | CLE08b001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | X |
| CLF06c | CL017 | 2007-04-03 | 2007-04-05 | CLE06c001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLF06d | CL017 | 2007-03-26 | 2007-04-05 | CLF06d001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC05d | CL018 | 2007-04-11 | 2007-04-12 | CLC05d001 | BDU33 | Bomb, practice, 25-lb | Spotting charge | Striker | |
| CLC05d | CL018 | 2007-04-11 | 2007-04-12 | CLC05d002 | BDU33 CART | Pyrotechnic | Spotting charge | N/A | |
| BIP = Blown in place | | | | | | | | | |

**Table 2-6. Cayo Lobo Demolition Operations**

| Demo Op ID | Demo Date | Demo Time | All Clear Time | Easting | Northing |
|---|---|---|---|---|---|
| CL001 | 2006-09-26 | 02:00:00 p.m. | 02:20:00 p.m. | 2896776.61 | 6659678.431 |
| CL002 | 2006-09-27 | 01:27:00 p.m. | 01:47:00 p.m. | 2896819.073 | 6659706.514 |
| CL003 | 2006-10-02 | 12:45:00 p.m. | 01:05:00 p.m. | 2896864.499 | 6659685.945 |
| CL004 | 2006-10-02 | 01:25:00 p.m. | 01:30:00 p.m. | 2896896.18 | 6659787.59 |
| CL005 | 2006-10-03 | 01:40:00 p.m. | 01:48:00 p.m. | 2896893.539 | 6659745.336 |
| CL006 | 2006-10-12 | 10:32:00 a.m. | 10:41:00 a.m. | 2897032.449 | 6659747.432 |
| CL007 | 2006-10-12 | 10:32:00 a.m. | 10:41:00 a.m. | 2896852.108 | 6659695.94 |
| CL008 | 2006-10-23 | 10:47:00 a.m. | 10:55:00 a.m. | 2897130.374 | 6659954.923 |
| CL009 | 2006-11-02 | 11:47:00 a.m. | 12:15:00 p.m. | 2897144.308 | 6659865.463 |
| CL010 | 2006-11-02 | 11:47:00 a.m. | 12:15:00 p.m. | 2896759.284 | 6659661.544 |
| CL011 | 2006-11-02 | 11:47:00 a.m. | 12:15:00 p.m. | 2896777.269 | 6659685.941 |
| CL012 | 2006-11-22 | 11:46:00 a.m. | 11:56:00 a.m. | 2896960.416 | 6659893.921 |
| CL013 | 2006-12-07 | 10:01:00 a.m. | 10:09:00 a.m. | 2896892.125 | 6660083.004 |
| CL014 | 2007-02-14 | 10:55:00 a.m. | 11:05:00 a.m. | 2897130.375 | 6660130.408 |

| Demo Op ID | Demo Date | Demo Time | All Clear Time | Easting | Northing |
|---|---|---|---|---|---|
| CL015 | 2007-03-13 | 11:28:00 a.m. | 11:40:00 a.m. | 2897123.546 | 6660262.028 |
| CL016 | 2007-04-05 | 11:06:00 a.m. | 11:11:00 a.m. | 2897188.141 | 6660160.476 |
| CL017 | 2007-04-05 | 11:06:00 a.m. | 11:11:00 a.m. | 2897038.848 | 6660324.46 |
| CL018 | 2007-04-12 | 10:43:00 a.m. | 10:48:00 a.m. | 2896525.57 | 6659980.688 |

2.4.3.2.2.02 All demolition shots were tamped with sand bags to reduce the possibility of fire and fragmentation dispersal, and for sound attenuation. EEG also used water jugs on most shots and pools on some of the shots. To reduce the potential for grass fires, water was pumped from the sea to wet down the vegetation before demolition operations. The SUXOS and the UXOQC/SO witnessed the destruction of all UXO and explosive material.

### 2.4.4 Management and Disposal of Munitions Debris

2.4.4.01 Munitions debris was collected from each grid, weighed in the grid found, and 100 percent inspected for absence of explosive materials by the UXOQC/SO and the SUXOS. The debris was not removed from the grid where it was found until after the debris was certified explosives-free. The debris was then securely transported to a locked and sealed 55-gallon drum. Each tamper-proof seal was identified with a unique number. When additional scrap was placed into the drum after it was opened, a new seal was used and the new seal number recorded. Two drums were used during this project to contain the munitions debris.

2.4.4.02 Following completion of field operations, the drums containing munitions debris were shipped via Caribbean Transportation Services to TES in California for final destruction, and certification per DoD regulation 4160.21-M-1. **Appendix I** contains the shipping and certification documents.

#### 2.4.4.1 Munitions Debris at Cerro Balcon

A total of 286.5 pounds of munitions debris was removed from the Cerro Balcon site (**Table 2-7**). An estimated 174 pounds of non-munitions debris was removed from the grid during sweep operations. Non-munitions debris was primarily old barbed wire fencing within the grids.

**Table 2-7. Field Weight of Munitions Debris Removed from Cerro Balcon**

| OE Grid ID | Week Ending | Munitions Debris (lbs) | Drum ID |
|---|---|---|---|
| CBA05 | 2006-06-16 | 37 | 0001 |
| CBA06 | 2006-06-16 | 14 | 0001 |
| CBA04 | 2006-06-23 | 5 | 0001 |
| CBD06 | 2006-06-23 | 12 | 0001 |
| CBC06 | 2006-06-30 | 5 | 0001 |
| CBF06 | 2006-06-30 | 4 | 0001 |
| CBB06 | 2006-06-30 | 15 | 0001 |
| CBB05 | 2006-07-07 | 12 | 0001 |
| CBB05 | 2006-07-07 | 3 | 0001 |
| CBE04b | 2006-07-14 | 8 | 0001 |
| CBC05 | 2006-07-14 | 0.5 | 0001 |
| CBC05 | 2006-07-14 | 0.5 | 0001 |
| CBD04 | 2006-07-21 | 38 | 0001 |
| CBD05 | 2006-07-21 | 4 | 0001 |
| CBD04 | 2006-07-21 | 10 | 0001 |
| CBE05 | 2006-07-28 | 11 | 0001 |
| CBC04 | 2006-07-28 | 4 | 0001 |
| CBB04 | 2006-08-04 | 12 | 0001 |
| CBB04 | 2006-08-04 | 2 | 0001 |
| CBC04 | 2006-08-11 | 1 | 0001 |
| CBZZ04 | 2006-09-08 | 19 | 0001 |
| CBZZ05 | 2006-12-08 | 18 | 0002 |
| CBZZ07d | 2007-01-26 | 4 | 0002 |
| CBZZ07c | 2007-01-26 | 8 | 0002 |
| CBZZ07a | 2007-01-26 | 4 | 0002 |
| CBH08c | 2007-01-26 | 8 | 0002 |
| CBA07a | 2007-02-09 | 7 | 0002 |
| CBA07c | 2007-02-09 | 8 | 0002 |
| CBYY07d | 2007-02-23 | 7 | 0002 |
| CBYY05c | 2007-02-23 | 5 | 0002 |
| CBYY07a | 2007-03-02 | 0.5 | 0002 |
| | **Total field weight** | **286.5 lbs** | |

#### 2.4.4.2 Munitions Debris at Cayo Lobo

A total field weight of 1,450 pounds of munitions debris was removed from the search grids on Cayo Lobo (**Table 2-8**). An additional 21 pounds of munitions debris from an expended projectile was removed from the rock area/surf zone on the west side of Cayo Lobo on March 1, 2007, and placed into the scrap bin (Drum 0002, Seal # 0615382). Approximately 24 pounds of non-munitions debris was removed from the sweep grids on Cayo Lobo. Additionally, more than 50 rubber tires were located on the cay. EEG was directed to leave those on the cay.

**Table 2-8. Field Weight of Munitions Debris Removed from Cayo Lobo**

| OE Grid ID | Week Ending | Munitions Debris (lbs) | Drum ID |
|---|---|---|---|
| CLB08 | 2006-10-06 | 122 | 0001 |
| CLD08c | 2006-10-27 | 5 | 0001 |
| CLD08a | 2006-10-27 | 18 | 0001 |
| CLC08 | 2006-10-27 | 300 | 0001 |
| CLD08b | 2006-11-03 | 140 | 0001 |
| CLD08d | 2006-11-03 | 60 | 0002 |
| CLB07c | 2006-11-03 | 25 | 0002 |
| CLD07a | 2006-11-24 | 7 | 0002 |
| CLD07c | 2006-11-24 | 45 | 0002 |
| CLD07d | 2006-11-24 | 120 | 0002 |
| CLD07a | 2006-12-08 | 37 | 0002 |
| CLB07c | 2006-12-08 | 16 | 0002 |
| CLD07b | 2006-12-08 | 58 | 0002 |
| CLD07d | 2006-12-08 | 20 | 0002 |
| CLC07b | 2006-12-08 | 212 | 0002 |
| CLE07a | 2007-02-09 | 29 | 0002 |
| CLE07d | 2007-02-09 | 60 | 0002 |
| CLE07c | 2007-02-16 | 3 | 0002 |
| CLE07b | 2007-02-16 | 20 | 0002 |
| CLF07b | 2007-03-02 | 25 | 0002 |
| CLF07b | 2007-03-16 | 25 | 0002 |
| CLE08a | 2007-03-23 | 35 | 0002 |
| CLF06d | 2007-03-30 | 25 | 0002 |
| CLE06c | 2007-04-06 | 25 | 0002 |
| CLC05d | 2007-04-13 | 18 | 0002 |
| | **Total field weight** | **1,450 lbs** | |

### 2.4.5 UXO Quality Assurance / Quality Control

2.4.5.01 The UXOQC/SO was responsible for ensuring compliance with all QC operations during this project, including implementing the Quality Control Plan and reporting all deficiencies to the project manager and the CEHNC site representative. The field checks for equipment used and applicable performance measures are described in **Table 2-9**. In cases where non-conformance was noted during the QC checks, the item was re-tested and assessed to determine whether a mechanical or operator error occurred. If the failure remained, the problem was resolved by removing the equipment or retraining the operator. Daily system checks rarely resulted in equipment removal.

**Table 2-9. Quality Control Checks, Parameters, and Corrective Actions**

| Measured Item | Controls Used | Parameter Measured | Corrective Action |
|---|---|---|---|
| Equipment operation | UXOQC/SO will verify that instrument checks are being conducted at least three times a day. UXOQC/SO will randomly affix inert target items beneath a blanket in such a manner as to conceal the number and types of items during the test. Operator will perform equipment balancing, then locate the items under the blanket. | Frequency and accuracy of measurement (pass / fail) | Equipment shall be maintained by the field personnel and will be either accepted or rejected. Rejected sensors will be tagged as non-operable and removed from the site after concurrence by SUXOS. |
| | UXOQC/SO will verify that the operator is able to consistently maintain a height of operation and ability of the equipment to detect target items. | Height must be equal to or less than the determined height. Operator must be able to easily locate the items buried at the site. | Equipment shall be maintained by the field personnel and will either be accepted or rejected. Rejected personal protective equipment (PPE) will be tagged and either repaired or thrown out after concurrence by site manager. |
| Grid layout | UXOQC/SO will inspect to ensure that the appropriate grid or subgrid corners are located and that sweep lanes are being set up in a proper manner. | UXOQC/SO will inspect the grid or subgrid layout operation and the setup of the grid lanes. The Quality Management System Checklist will be completed with his findings. | The layout of the grids or subgrids will be either accepted or rejected. If the width of the grid lanes is less than or equal to 4 feet, the work will be acceptable. If the distance is greater than 4 feet, UXOQC/SO will ask the team leader to reset the lanes and redo the search already conducted. |

| Measured Item | Controls Used | Parameter Measured | Corrective Action |
|---|---|---|---|
| Search techniques | UXOQC/SO will observe the search techniques. The search techniques must be accomplished in a manner that all target items identified in Table 6-1, Step 6, in the Work Plan (EEG 2006) are located. Hazardous items found that are smaller will also be removed. | UXOQC/SO will check that proper techniques are being used; that the speed of the operation is such that the target items will be checked to ensure sensor head speed is sufficient to locate MEC items, sweeping at the appropriate height; and that the sweep coverage is complete under trees and shrubs. He also ensures that all surface items are immediately identified and that partially penetrating items are being flagged and excavated, and that all MEC items are properly flagged and located for GPS data collection. Acceptance of these procedures will be noted in the daily Quality Management System Checklist. | If improper search techniques are being employed, UXOQC/SO will discuss the deficiencies with SUXOS and will get concurrence for the proper corrective action. He will re-inspect the operation to ensure that the corrective action is being applied. |
| | UXOQC/SO will randomly seed areas of the grid(s) or subgrid(s) with no more than 10 concealed, inert target items to be detected as a test of equipment and operation of the equipment. The number of items will be randomly chosen. Seed items will consist of 6-inch iron nail spikes painted blue for easy identification. | Each team must be able to find and identify all inert target items seeded within a grid or subgrid. The team leader will record the lane number, the operator number, and the item found. | If teams fail to detect and identify one item among those seeded in a grid or subgrid, a root cause analysis will be performed. |
| | UXOQC/SO will perform field-level QC checks by lanes or groups of lanes with the purpose of identifying missed items of concern. | If MEC is found, a QC failure is logged. If an anomalous item (a piece of metal smaller than the QC/QA failure threshold) is found and was not positively identified during the initial sweep, the corrective action in the adjoining column will be initiated, and the anomaly will be logged on the QC grid log along with the location, the operator, the action taken, and the percent swept. | If one anomalous item is found, UXOQC/SO will evaluate the failure and the equipment will be rechecked and its operation evaluated. If 5 anomalous items are found, EEG will resurvey 10 percent of the grid or subgrid, or lane groups within that grid or subgrid, at the operator level. If more than 5 anomalous items are found, EEG will resurvey 25 percent of the grid or subgrid, or lane groups within that grid or subgrid, at the operator level. If 10 anomalous items are found, EEG will resurvey the entire grid or subgrid, or all lane groups for that operator within that grid or subgrid. |

| Measured Item | Controls Used | Parameter Measured | Corrective Action |
|---|---|---|---|
| Mapping and UXO data | UXOQC/SO will inspect the location of the control point and ensure proper setup of the GPS. Appropriate consideration will be given to satellite coverage and the stable positioning of the device on a tripod. | SUXOS will ensure that the base station, if used, is placed over the control point and that the height of instrument is documented; that the data collection rate is 10 seconds; that the batteries are charged; and that the instrument is in proper working condition. He will assign responsibility of the GPS setup to a team member who will be responsible for ensuring that the equipment is operating properly and that it is fully charged. | UXOQC/SO will inspect the setup on a daily basis. If the setup is found to be improper, the data must be re-collected. If the data cannot be re-collected, a non-conformance memorandum will be issued. |
| | Site manager will download and inspect the data collected. | Site manager will check to ensure that the data collected is correctly and that the location IDs for soil samples, MEC locations, and demolition locations match the descriptions and location IDs provided in the database. | Site manager will download and inspect the GPS data collected and ensure that the process has been completed properly each day data is collected. If the data is incomplete or does not meet the accuracy requirements, site manager will contact the project manager to determine what corrective action is necessary. |

2.4.5.02 Several QC checks were performed by the SUXOS at the grid level. Grids CBB04 and CBC05 at Cerro Balcon were initially failed by the UXOQC/SO because the sweep team failed to meet performance metrics; 55 man-hours were expended to re-sweep the two grids. A fuze was located upon re-sweep of grid CBC05. Grid CLB08 at Cayo Lobo was also initially failed by the UXOQC/SO because the sweep team failed to meet performance metrics; 48.5 man-hours were expended to re-sweep the grid. Upon re-sweep of the grid, two additional BDU33 25-pound practice bombs were located. After the grids were turned over to the CEHNC on-site representative, they were all accepted on the first QA check. The CEHNC safety representative signed Form 948 to acknowledge acceptance for all of the grids and subgrids. The signed 948 forms are included in **Appendix G.**

## 2.5 Soil Sample Collection and Analyses

Soil samples were collected in accordance with the Sampling and Analysis Plan (Appendix E of the Final Work Plan) (EEG 2006). During 2006, pre- and post-detonation surface soil samples were collected at each detonation location. Beginning in January 2007, only post-detonation samples were collected. Sampling equipment was pre-cleaned, pre-packaged, and dedicated to each individual sample point. Complete results of the analyses are found in the Quality Control

Summary Report (**Appendix J**). A Microsoft Access database of analytical results of the field sampling effort is included in **Appendix K**. The Access database includes all sample results.

### 2.5.1 Soil Samples from Cerro Balcon

2.5.1.01 Soil samples collected at the Cerro Balcon site are listed in **Table 2-10**. Samples were collected from eight detonation locations.

**Table 2-10. Surface Soil Samples Collected at Cerro Balcon**

| Sample ID | Demo Op ID | Sample Point | Sampling Time | Sample Date | Parent Sample |
|---|---|---|---|---|---|
| SSCBB05001PRE | CB001 | sam_pt001 | 08:30 a.m. | 2006-07-06 | |
| SSCBB05001POST | CB001 | sam_pt001 | 11:30 a.m. | 2006-07-06 | |
| SSCBC05001PRE | CB002 | sam_pt002 | 08:00 a.m. | 2006-07-13 | |
| SSCBC05001PREMS | CB002 | sam_pt002 | 08:00 a.m. | 2006-07-13 | |
| SSCBC05001PREMSD | CB002 | sam_pt002 | 08:00 a.m. | 2006-07-13 | |
| SSCBC05001POST | CB002 | sam_pt002 | 10:10 a.m. | 2006-07-13 | |
| SSCBD04001PRE | CB004 | sam_pt003 | 09:00 a.m. | 2006-07-20 | |
| SSCBD04001POST | CB004 | sam_pt003 | 01:15 p.m. | 2006-07-20 | |
| SSCBD04002PRE | CB003 | sam_pt004 | 09:00 a.m. | 2006-07-20 | |
| SSCBD04002POST | CB003 | sam_pt004 | 01:15 p.m. | 2006-07-20 | |
| SSCBC04001PRE | CB005 | sam_pt005 | 07:28 a.m. | 2006-08-07 | |
| REPLICATE #1 | CB005 | sam_pt005 | 07:28 a.m. | 2006-08-07 | SSCBC04001PRE |
| SSCBC04001POST | CB005 | sam_pt005 | 10:04 a.m. | 2006-08-07 | |
| SSCBZZ07c001POST | CB006 | sam_pt019 | 11:57 a.m. | 2007-01-22 | |
| REPLICATE #5 | CB006 | sam_pt019 | 11:57 a.m. | 2007-01-22 | SSCBZZ07c001POST |
| SSCBH08001POST | CB007 | sam_pt020 | 11:40 a.m. | 2007-01-22 | |
| SSCBYY05c001POST | CB008 | sam_pt022 | 10:44 a.m. | 2007-02-22 | |

2.5.1.02 The soil samples were analyzed at Severn Trent Laboratories (STL), Chicago, for Target Analyte List (TAL) metals plus strontium by Environmental Protection Agency (EPA) Methods 6010B/7471A, for explosives by EPA Method 8330, and for NG/PETN by EPA Method 8332M; perchlorate was analyzed at STL Sacramento by Method 314.0 (see **Table 2-11**). In addition, two split samples—SSCBC04001PRE(SPLIT) and SSCBZZ07c001POST(SPLIT)—were sent to USACE's QA laboratories. A matrix spike and a matrix spike duplicate were run from sample SSCBC05001PRE.

**Table 2-11. Analyses Conducted on Surface Soil Samples Collected at Cerro Balcon**

| Sample ID | Metals 6010B | Mercury 7471A | Explosives 8330 | NG / PETN 8332M | Perchlorate 314.0 | Parent Sample |
|---|---|---|---|---|---|---|
| REPLICATE #1 | X | X | X | X | | SSCBC04001PRE |
| REPLICATE #5 | X | X | X | X | X | SSCBZZ07c001POST |
| SSCBB05001POST | X | X | X | X | X | |
| SSCBB05001PRE | X | X | X | X | X | |
| SSCBC04001POST | X | X | X | X | X | |
| SSCBC04001PRE | X | X | X | X | X | |
| SSCBC05001POST | X | X | X | X | X | |
| SSCBC05001PRE | X | X | X | X | X | |
| SSCBD04001POST | X | X | X | X | X | |
| SSCBD04001PRE | X | X | X | X | X | |
| SSCBD04002POST | X | X | X | X | X | |
| SSCBD04002PRE | X | X | X | X | X | |
| SSCBH08001POST | X | X | X | X | X | |
| SSCBYY05c001POST | X | X | X | X | X | |
| SSCBZZ07c001POST | X | X | X | X | X | |
| **Number of analyses** | **15** | **15** | **15** | **15** | **14** | |

Note: REPLICATE #1 did not include perchlorate analysis because sample arrived at laboratory out of temperature control limits.

2.5.1.03 All chemical analytical data is provided in a database included as **Appendix K** of this report. A table of all detected chemical analytes is included in **Appendix** K. Octahydro-1,3,5,7-tetranitro-1,3,5,7 tetrazocine (HMX) is the only explosive compound detected in surface soils. It was detected only in pre-detonation sample SCBB05001PRE (sample point 001) at an estimated concentration of 46 micrograms per kilogram (µg/kg). The reporting limit for HMX in the sample was 200 µg/kg.

2.5.1.04 Perchlorate was detected in two post-detonation soil samples from Cerro Balcon (see **Appendix K** database). Sample SSCBB05001POST (sample point 001) indicated an estimated perchlorate concentration of 19 µg/kg and sample SSCBYY05C001POST (sample point 022) indicated a perchlorate concentration of 44.4 µg/kg. Reporting limits for those two samples were 60.2 µg/kg and 44.4 µg/kg, respectively.

2.5.1.05 **Table 2-12** provides a summary of metals detected at the site and their ranges of concentration. Many of the metals were detected in or near 100 percent of the samples. These may be the result of background concentrations.

**Table 2-12. Basic Statistics: Metals at Cerro Balcon**

| Analyte | Sample Type | Number of Detects | Number of Samples | Percent Detects | Concentrations | | |
|---|---|---|---|---|---|---|---|
| | | | | | Minimum | Maximum | Average |
| Aluminum | Pre | 6 | 6 | 100 | 24000.00 | 28000.00 | 26166.67 |
| Aluminum | Post | 9 | 9 | 100 | 15000.00 | 31000.00 | 21333.33 |
| Antimony | Pre | 4 | 6 | 67 | 0.84 | 1.6 | 1.15 |
| Antimony | Post | 7 | 9 | 87 | 0.87 | 7.20 | 2.97 |
| Arsenic | Pre | 6 | 6 | 100 | 0.92 | 3.60 | 2.00 |
| Arsenic | Post | 9 | 9 | 100 | 1.10 | 8.20 | 4.28 |
| Barium | Pre | 6 | 6 | 100 | 45.00 | 60.00 | 52.00 |
| Barium | Post | 9 | 9 | 100 | 58.00 | 170.00 | 88.22 |
| Beryllium | Pre | 6 | 6 | 100 | 0.64 | 1.00 | 0.79 |
| Beryllium | Post | 9 | 9 | 100 | 0.45 | 1.40 | 0.95 |
| Cadmium | Pre | 4 | 6 | 67 | 0.11 | 0.84 | 0.40 |
| Cadmium | Post | 7 | 9 | 78 | 0.06 | 0.94 | 0.41 |
| Calcium | Pre | 6 | 6 | 100 | 7100.00 | 9500.00 | 8366.67 |
| Calcium | Post | 9 | 9 | 100 | 5100.00 | 12000.00 | 7100.00 |
| Chromium | Pre | 6 | 6 | 100 | 40.00 | 110.00 | 67.33 |
| Chromium | Post | 9 | 9 | 100 | 14.00 | 130.00 | 38.22 |
| Cobalt | Pre | 6 | 6 | 100 | 24.00 | 33.00 | 27.17 |
| Cobalt | Post | 9 | 9 | 100 | 14.00 | 35.00 | 23.22 |
| Copper | Pre | 6 | 6 | 100 | 86.00 | 110.00 | 98.83 |
| Copper | Post | 9 | 9 | 100 | 97.00 | 20000.00 | 3485.22 |
| Iron | Pre | 6 | 6 | 100 | 45000.00 | 57000.00 | 48666.67 |
| Iron | Post | 9 | 9 | 100 | 35000.00 | 110000.00 | 60666.67 |
| Lead | Pre | 6 | 6 | 100 | 2.90 | 9.00 | 5.57 |
| Lead | Post | 9 | 9 | 100 | 7.50 | 19000.00 | 4610.94 |
| Magnesium | Pre | 6 | 6 | 100 | 8800.00 | 12000.00 | 10566.67 |
| Magnesium | Post | 9 | 9 | 100 | 4000.00 | 12000.00 | 7466.67 |
| Manganese | Pre | 6 | 6 | 100 | 1300.00 | 1700.00 | 1466.67 |
| Manganese | Post | 9 | 9 | 100 | 810.00 | 2000.00 | 1394.44 |
| Mercury | Pre | 6 | 6 | 100 | 0.03 | 0.05 | 0.04 |
| Mercury | Post | 9 | 9 | 100 | 0.02 | 4.00 | 0.47 |

| Analyte | Sample Type | Number of Detects | Number of Samples | Percent Detects | Concentrations | | |
|---|---|---|---|---|---|---|---|
| | | | | | Minimum | Maximum | Average |
| Nickel | Pre | 6 | 6 | 100 | 21.00 | 46.00 | 30.50 |
| Nickel | Post | 9 | 9 | 100 | 8.60 | 51.00 | 20.61 |
| Potassium | Pre | 6 | 6 | 100 | 4800.00 | 7300.00 | 5783.33 |
| Potassium | Post | 9 | 9 | 100 | 2500.00 | 5700.00 | 3855.56 |
| Selenium | Pre | 4 | 6 | 67 | 0.55 | 3.20 | 1.56 |
| Selenium | Post | 8 | 9 | 89 | 0.55 | 15.00 | 4.28 |
| Silver | Pre | 6 | 6 | 100 | 0.30 | 0.47 | 0.37 |
| Silver | Post | 9 | 9 | 100 | 0.19 | 1.00 | 0.42 |
| Sodium | Pre | 5 | 6 | 83 | 55.00 | 420.00 | 267.50 |
| Sodium | Post | 8 | 9 | 89 | 70.00 | 550.00 | 290.00 |
| Strontium | Pre | 6 | 6 | 100 | 29.00 | 50.00 | 38.67 |
| Strontium | Post | 9 | 9 | 100 | 19.00 | 64.00 | 33.67 |
| Thallium | Pre | 5 | 6 | 83 | 0.55 | 4.70 | 3.01 |
| Thallium | Post | 3 | 9 | 33 | 0.55 | 4.20 | 1.67 |
| Vanadium | Pre | 6 | 6 | 100 | 150.00 | 190.00 | 170.00 |
| Vanadium | Post | 9 | 9 | 100 | 97.00 | 270.00 | 177.44 |
| Zinc | Pre | 6 | 6 | 100 | 70.00 | 110.00 | 88.33 |
| Zinc | Post | 9 | 9 | 100 | 63.00 | 200.00 | 109.67 |
| Units = milligrams per kilogram (mg/kg) | | | | | | | |

### 2.5.2 Soil Samples from Cayo Lobo

2.5.2.01 Soil samples collected at the Cayo Lobo site are listed in **Table 2-13**. A total of 13 complete pre-detonation and 21 complete post-detonation samples were collected. No background samples were collected.

**Table 2-13. Surface Soil Samples Collected at Cayo Lobo**

| Sample ID | Demo Op ID | Sample Point | Sampling Time | Sample Date | Parent Sample |
|---|---|---|---|---|---|
| SSCLB08001 PRE | CL001 | sam_pt006 | 09:50 a.m. | 2006-09-26 | |
| SSCLB08001 POST | CL001 | sam_pt006 | 02:53 p.m. | 2006-09-26 | |
| SSCLB07002 PRE | CL002 | sam_pt007 | 12:00 p.m. | 2006-09-27 | |
| SSCLB07002 POST | CL002 | sam_pt007 | 01:50 p.m. | 2006-09-27 | |
| SSCLB08002PRE | CL003 | sam_pt008 | 10:50 a.m. | 2006-10-02 | |
| SSCLB08002POST | CL003 | sam_pt008 | 12:50 p.m. | 2006-10-02 | |

| Sample ID | Demo Op ID | Sample Point | Sampling Time | Sample Date | Parent Sample |
|---|---|---|---|---|---|
| SSCLC08001PRE | CL004 | sam_pt009 | 01:05 p.m. | 2006-10-02 | |
| SSCLC08001POST | CL004 | sam_pt009 | 01:32 p.m. | 2006-10-02 | |
| SSCLC08005PRE | CL005 | sam_pt010 | 12:05 p.m. | 2006-10-03 | |
| SSCLC08005POST | CL005 | sam_pt010 | 01:50 p.m. | 2006-10-03 | |
| REPLICATE #2 | CL005 | sam_pt010 | 11:59 p.m. | 2006-10-03 | SSCLC08005PRE |
| SSCLB08003PRE | CL007 | sam_pt011 | 09:00 a.m. | 2006-10-12 | |
| SSCLB08003POST | CL007 | sam_pt011 | 11:00 a.m. | 2006-10-12 | |
| SSCLC08006PRE | CL006 | sam_pt012 | 09:05 a.m. | 2006-10-12 | |
| SSCLC08006POST | CL006 | sam_pt012 | 11:00 a.m. | 2006-10-12 | |
| SSCLC08006POSTMS | CL006 | sam_pt012 | 11:00 a.m. | 2006-10-12 | |
| SSCLC08006POSTMSD | CL006 | sam_pt012 | 11:00 a.m. | 2006-10-12 | |
| REPLICATE #3 | CL006 | sam_pt012 | 11:00 a.m. | 2006-10-12 | SSCLC08006POST |
| SSCLD08a001PRE | CL008 | sam_pt013 | 09:50 a.m. | 2006-10-23 | |
| SSCLD08a001POST | CL008 | sam_pt013 | 11:30 a.m. | 2006-10-23 | |
| SSCLB07a001PRE | CL010 | sam_pt014 | 10:07 a.m. | 2006-11-02 | |
| SSCLB07a001POST | CL010 | sam_pt014 | 12:35 p.m. | 2006-11-02 | |
| SSCLB07c001PRE | CL011 | sam_pt015 | 10:09 a.m. | 2006-11-02 | |
| SSCLB07c001POST | CL011 | sam_pt015 | 12:57 p.m. | 2006-11-02 | |
| SSCLD08b001PRE | CL009 | sam_pt016 | 10:35 a.m. | 2006-11-02 | |
| SSCLD08b001POST | CL009 | sam_pt016 | 01:09 p.m. | 2006-11-02 | |
| SSCLD07d001PRE | CL012 | sam_pt017 | 10:05 a.m. | 2006-11-22 | |
| SSCLD07d001POST | CL012 | sam_pt017 | 12:05 p.m. | 2006-11-22 | |
| SSCLD07b001PRE | CL013 | sam_pt018 | 09:30 a.m. | 2006-12-07 | |
| REPLICATE #4 | CL013 | sam_pt018 | 10:20 a.m. | 2006-12-07 | SSCLD07b001POST |
| SSCLD07b001POSTMS | CL013 | sam_pt018 | 10:20 a.m. | 2006-12-07 | |
| SSCLD07b001POST | CL013 | sam_pt018 | 10:20 a.m. | 2006-12-07 | |
| SSCLD07b001POSTMSD | CL013 | sam_pt018 | 10:20 a.m. | 2006-12-07 | |
| SSCLE07c001POST | CL014 | sam_pt021 | 11:15 a.m. | 2007-02-14 | |
| SSCLF07b001POST | CL015 | sam_pt023 | 11:44 a.m. | 2007-03-13 | |
| SSCLE08b001POST | CL016 | sam_pt024 | 11:43 a.m. | 2007-04-05 | |
| SSCLF06d001POST | CL017 | sam_pt025 | 11:36 a.m. | 2007-04-05 | |
| SSCLC05d001POST | CL018 | sam_pt026 | 10:50 a.m. | 2007-04-12 | |
| REPLICATE #6 | CL018 | sam_pt026 | 10:50 a.m. | 2007-04-12 | SSCLC05d001POST |
| Note: REPLICATE #2 was analyzed for perchlorate only. | | | | | |

2.5.2.02 The soil samples were analyzed at STL Chicago for TAL metals plus strontium by EPA Methods 6010B/7471A, for explosives by EPA Method 8330, and for NG/PETN by EPA Method 8332M; perchlorate was analyzed at STL Sacramento by EPA Method 314.0 (see **Table 2-14**). In addition, two split samples—SSCLC05d001POST(SPLIT) and SSCLC08006POST(SPLIT)—were sent to USACE's QA laboratories. Matrix spikes and matrix spike duplicates were run from samples SSCLC08006POST and SSCLD07b001POST.

**Table 2-14. Analyses Conducted on Surface Soil Samples Collected at Cayo Lobo**

| Sample ID | Metals 6010B | Mercury 7471A | Explosives 8330 | NG / PETN 8332M | Perchlorate 314.0 | Parent Sample |
|---|---|---|---|---|---|---|
| REPLICATE #2 | | | | | X | SSCLC08005PRE |
| REPLICATE #3 | X | X | X | X | X | SSCLC08006POST |
| REPLICATE #4 | X | X | X | X | X | SSCLD07B001POST |
| REPLICATE #6 | X | X | X | X | X | SSCLC05d001POST |
| SSCLB07002 POST | X | X | X | X | X | |
| SSCLB07002 PRE | X | X | X | X | X | |
| SSCLB07a001POST | X | X | X | X | X | |
| SSCLB07a001PRE | X | X | X | X | X | |
| SSCLB07c001POST | X | X | X | X | X | |
| SSCLB07c001PRE | X | X | X | X | X | |
| SSCLB08001 POST | X | X | X | X | X | |
| SSCLB08001 PRE | X | X | X | X | X | |
| SSCLB08002POST | X | X | X | X | X | |
| SSCLB08002PRE | X | X | X | X | X | |
| SSCLB08003POST | X | X | X | X | X | |
| SSCLB08003PRE | X | X | X | X | X | |
| SSCLC05d001POST | X | X | X | X | X | |
| SSCLC08001POST | X | X | X | X | X | |
| SSCLC08001PRE | X | X | X | X | X | |
| SSCLC08005POST | X | X | X | X | X | |
| SSCLC08005PRE | X | X | X | X | X | |
| SSCLC08006POST | X | X | X | X | X | |
| SSCLC08006PRE | X | X | X | X | X | |
| SSCLD07b001POST | X | X | X | X | X | |
| SSCLD07b001PRE | X | X | X | X | X | |
| SSCLD07d001POST | X | X | X | X | X | |
| SSCLD07d001PRE | X | X | X | X | X | |

| Sample ID | Metals 6010B | Mercury 7471A | Explosives 8330 | NG / PETN 8332M | Perchlorate 314.0 | Parent Sample |
|---|---|---|---|---|---|---|
| SSCLD08a001POST | X | X | X | X | X | |
| SSCLD08a001PRE | X | X | X | X | X | |
| SSCLD08b001POST | X | X | X | X | X | |
| SSCLD08b001PRE | X | X | X | X | X | |
| SSCLE07c001POST | X | X | X | X | X | |
| SSCLE08b001POST | X | X | X | X | X | |
| SSCLF06d001POST | X | X | X | X | X | |
| SSCLF07b001POST | X | X | X | X | X | |
| **Number of analyses** | **34** | **34** | **34** | **34** | **35** | |
| Note: REPLICATE #2 was analyzed for perchlorate only. | | | | | | |

2.5.2.03 All chemical analytical data is provided in a database included as **Appendix K** of this report. A table of all detectable chemical analytes is also included in **Appendix K**.

2.5.2.04 Perchlorate was detected in three pre-detonation and two post-detonation samples. A summary of those detections is included in **Table 2-15**.

**Table 2-15. Perchlorate Detected at Cayo Lobo**

| Sample ID | Sample Point | Analyte | Result |
|---|---|---|---|
| SSCLB08001 PRE | sam_pt006 | Perchlorate | 95 |
| SSCLB07002 PRE | sam_pt007 | Perchlorate | 70 |
| SSCLB08002PRE | sam_pt008 | Perchlorate | 13.1J |
| SSCLB07A001POST | sam_pt014 | Perchlorate | 8.9J |
| SSCLE07C001POST | sam_pt021 | Perchlorate | 646 |
| Units = µg/kg<br>J = Estimated value | | | |

2.5.2.05 HMX, NG, PETN, and RDX were detected in samples from Cayo Lobo (**Table 2-16**).

**Table 2-16. Explosives Detected at Cayo Lobo**

| Sample ID | Sample Point | Analyte | Result |
|---|---|---|---|
| SSCLE07C001POST | sam_pt021 | HMX | 2300 |
| SSCLD08A001PRE | sam_pt013 | NG | 180J |
| SSCLD08A001POST | sam_pt013 | NG | 330 |

| Sample ID | Sample Point | Analyte | Result |
|---|---|---|---|
| SSCLF06d001POST | sam_pt025 | PETN | 260J |
| SSCLE07C001POST | sam_pt021 | RDX | 92000 |
| SSCLF07b001POST | sam_pt023 | RDX | 870 |
| Units = µg/kg<br>J = Estimated value | | | |

2.5.2.06 Several metals were detected in samples collected at Cayo Lobo. **Table 2-17** provides a summary of those detections. The analytical data from Cayo Lobo is included in **Appendix K**.

**Table 2-17. Basic Statistics: Metals at Cayo Lobo**

| Analyte | Sample Type | Number of Detects | Number of Samples | Percent Detects | Concentrations | | |
|---|---|---|---|---|---|---|---|
| | | | | | Minimum | Maximum | Average |
| Aluminum | Pre | 13 | 13 | 100 | 25000.00 | 41000.00 | 32000.00 |
| Aluminum | Post | 21 | 21 | 100 | 18000.00 | 42000.00 | 30571.43 |
| Antimony | Pre | 12 | 13 | 92 | 0.76 | 1.70 | 1.13 |
| Antimony | Post | 21 | 21 | 100 | 0.67 | 2.80 | 1.32 |
| Arsenic | Pre | 2 | 13 | 15 | 0.44 | 0.90 | 0.64 |
| Arsenic | Post | 14 | 21 | 67 | 0.48 | 5.40 | 1.14 |
| Barium | Pre | 13 | 13 | 100 | 18.00 | 53.00 | 35.15 |
| Barium | Post | 21 | 21 | 100 | 22.00 | 56.00 | 35.43 |
| Beryllium | Pre | 13 | 13 | 100 | 0.26 | 0.51 | 0.38 |
| Beryllium | Post | 21 | 21 | 100 | 0.27 | 1.60 | 0.60 |
| Cadmium | Pre | 3 | 13 | 23 | 0.08 | 0.55 | 0.18 |
| Cadmium | Post | 10 | 21 | 48 | 0.09 | 9.00 | 0.73 |
| Calcium | Pre | 13 | 13 | 100 | 2800.00 | 12000.00 | 7892.31 |
| Calcium | Post | 21 | 21 | 100 | 4700.00 | 13000.00 | 8638.10 |
| Chromium | Pre | 13 | 13 | 100 | 19.00 | 37.00 | 27.85 |
| Chromium | Post | 21 | 21 | 100 | 16.00 | 110.00 | 39.10 |
| Cobalt | Pre | 13 | 13 | 100 | 16.00 | 34.00 | 25.62 |
| Cobalt | Post | 21 | 21 | 100 | 15.00 | 37.00 | 27.14 |
| Copper | Pre | 13 | 13 | 100 | 58.00 | 92.00 | 75.38 |
| Copper | Post | 21 | 21 | 100 | 72.00 | 2600.00 | 900.10 |
| Iron | Pre | 13 | 13 | 100 | 34000.00 | 83000.00 | 49307.69 |
| Iron | Post | 21 | 21 | 100 | 38000.00 | 89000.00 | 55666.67 |
| Lead | Pre | 13 | 13 | 100 | 1.10 | 4.20 | 2.92 |
| Lead | Post | 21 | 21 | 100 | 2.50 | 650.00 | 185.66 |

| Analyte | Sample Type | Number of Detects | Number of Samples | Percent Detects | Concentrations | | |
|---|---|---|---|---|---|---|---|
| | | | | | Minimum | Maximum | Average |
| Magnesium | Pre | 13 | 13 | 100 | 11000.00 | 18000.00 | 13538.46 |
| Magnesium | Post | 21 | 21 | 100 | 6400.00 | 21000.00 | 13447.62 |
| Manganese | Pre | 13 | 13 | 100 | 310.00 | 1600.00 | 953.85 |
| Manganese | Post | 21 | 21 | 100 | 700.00 | 1800.00 | 1023.33 |
| Mercury | Pre | 12 | 13 | 92 | 0.01 | 0.05 | 0.02 |
| Mercury | Post | 14 | 21 | 67 | 0.01 | 0.04 | 0.02 |
| Nickel | Pre | 13 | 13 | 100 | 15.00 | 24.00 | 20.38 |
| Nickel | Post | 21 | 21 | 100 | 17.00 | 48.00 | 24.95 |
| Potassium | Pre | 13 | 13 | 100 | 1300.00 | 4700.00 | 3453.85 |
| Potassium | Post | 21 | 21 | 100 | 1300.00 | 4800.00 | 3390.48 |
| Selenium | Pre | 9 | 13 | 69 | 0.49 | 1.50 | 0.88 |
| Selenium | Post | 18 | 21 | 86 | 0.55 | 5.90 | 1.99 |
| Silver | Pre | 12 | 13 | 92 | 0.14 | 0.39 | 0.23 |
| Silver | Post | 21 | 21 | 100 | 0.12 | 0.44 | 0.24 |
| Sodium | Pre | 13 | 13 | 100 | 1100.00 | 6800.00 | 2561.54 |
| Sodium | Post | 21 | 21 | 100 | 1400.00 | 8400.00 | 2938.10 |
| Strontium | Pre | 13 | 13 | 100 | 15.00 | 57.00 | 32.54 |
| Strontium | Post | 21 | 21 | 100 | 22.00 | 61.00 | 35.57 |
| Thallium | Pre | 2 | 13 | 15 | 0.49 | 4.90 | 1.15 |
| Thallium | Post | 6 | 20 | 30 | 0.55 | 3.60 | 1.5 |
| Vanadium | Pre | 13 | 13 | 100 | 140.00 | 240.00 | 205.38 |
| Vanadium | Post | 21 | 21 | 100 | 110.00 | 290.00 | 198.10 |
| Zinc | Pre | 13 | 13 | 100 | 43.00 | 150.00 | 60.85 |
| Zinc | Post | 21 | 21 | 100 | 36.00 | 120.00 | 63.67 |
| Units = mg/kg | | | | | | | |

# 3.0 Lessons Learned

## 3.1 Schedule Impacts

3.1.01 Working on the cays requires strict coordination with the stakeholders to ensure that operations do not impact nesting patterns of endangered animal species. Close coordination with FWS is also imperative all year, as other species may also be affected. Access to the cays is generally prohibited from April through October. The seas during those months are the calmest.

3.1.02 The period of access to the cays allowed by FWS is also the period where the seas are the roughest. Cayo Lobo has only two safe access points, and only one was available during the period of operation due to rough seas.

3.1.03 To reduce delays of the field crew, EEG used a small boat to perform reconnaissance each day before committing a full crew for access to Cayo Lobo. Even with this precaution, the seas could change en route, and access could be impossible once the crew arrived. Access to Cayo Lobo was available only about 60 percent of the time that crews were committed.

## 3.2 Explosives Operation Coordination

3.2.01 EEG coordinated all explosives operations with the following local authorities and regulatory agencies:

- Puerto Rico EQB
- FWS
- Puerto Rico DNER
- Puerto Rico police
- Municipality of Culebra
- Municipality fire department
- Municipality police
- Federal Aviation Administration (FAA)

3.2.02 Before the start of the field effort, EEG personnel mapped out a response plan with the fire department. EEG had equipment and operators available to ensure that any fires that might result from its operations could be contained. Additionally, EEG saturated the area with water before demolition.

3.2.03 EEG also contacted the FAA because the work sites were along the flight path of the airport and low-flying aircraft were in the area. The coordinates of the exclusion zone were provided to FAA and a Notice to Airmen was issued.

## 3.3 Communications and Security

EEG enlisted the help of a local resident to help with communications. She was able to enhance EEG's ability to communicate with other residents and to help schedule a security team for the explosives magazines. She was also able to help EEG locate local resources and interact with local agency personnel, as a result helping to lower the cost of operations.

## 3.4 Explosives Transport

EEG worked with the United States Coast Guard, the Puerto Rico port authority, and the Puerto Rico police bomb squad to ensure that the explosives were allowed to be transported to a boat for shipping to Culebra Island. The explosives were handed off to EEG by the supplier using a police escort. With approval of the port authority, EEG was able to use the commercial dock in Fajardo to transfer the explosives to a boat and ultimately to Culebra Island. The dock at the Puerto Rico DNER, owned by the Municipality of Culebra, was used to offload the explosives because of its proximity to the magazine, which could be reached without crossing populated areas.

## 3.5 Explosives Disposal

EEG coordinated operations with the Federal Bureau of Investigation (FBI) during the field effort to ensure the safety of the explosives. During the Christmas break, EEG transported the explosives to the FBI for storage, and after the field effort, EEG transferred custody of the explosives to the FBI for training purposes. This action saved both the FBI and CEHNC money, as the cost of transporting the explosives was much lower than the cost of disposal and replacement.

## 3.6 Munitions Debris Disposal

No smelters are located in Puerto Rico, thus either a portable smelter would have to be brought in or the munitions debris would have to be shipped to a location off the island for final burning. Due to the small amount of munitions debris, EEG opted to ship it to the United States mainland for disposal after it was demilled on site.

## 3.7 Vegetation Clearing

3.7.01 The vegetation in the Cerro Balcon area consists of dense mesquite, acacia, and grasses. The mesquite and acacia are difficult to cut due to their woody nature and long thorns. The mesquite averaged approximately 6 feet tall in the area of the site.

3.7.02 TES performed the initial vegetation cutting using a TAZ II. The unit was able to cut the tall mesquite brush down to ground level, making a mulch of the brush. EEG used magnetometer assistance to ensure the removal of items found beneath the brush.

3.7.03 Even with use of the TAZ, it was possible to reduce the vegetation only an average of one acre per day in the extreme environment. The cost of using the TAZ, factoring in mobilization and an oversight person, is approximately $4,500 per day. The cost of an eight-man crew, including equipment and personnel, is approximately $2,800 per day (minus management personnel and expenses). A four-man crew can remove only about a quarter acre per day, for a cost of approximately $11,200 per acre. The cost of using the TAZ was therefore 60 percent less than the cost of hand-cutting the vegetation.

# 4.0 Summary

## 4.1 Removal Action

4.1.01 EEG was contracted by CEHNC, under contract W912DY-05-D-0007, Task Order 0001, and in accordance with the 1997 Action Memorandum prepared by ESE, to provide non-time-critical surface removal of MEC on Culebra Island and adjacent cays. The objective of the task order was to safely locate, identify, recover, evaluate, manage, and make final disposition of MEC and other munitions at various FUDS, property adjoining FUDS, and other federally controlled and owned sites that had been potentially impacted by MEC or other munitions-related operations. Based on the Final Work Plan (EEG 2006), EEG was given written notice to proceed with the surface removal action on April 4, 2006.

4.1.02 Surface MEC were located at the site using electromagnetic-assisted technologies. The MEC items found were destroyed in accordance with industry standard procedures. Approximately 1,758 pounds of munitions debris was removed from Cerro Balcon and Cayo Lobo. The two drums containing munitions debris were shipped to TES in California for final demilling and destruction, and certification per DoD regulation 4160.21-M-1.

4.1.03 Even though surface MEC was removed from the site, areas outside of the specific search grids potentially contain additional MEC that erosion of surface soils or land-clearing operations might uncover. For example, grid CBH08 on the southern slope of Cerro Balcon was not in the original search area. Land clearing by the landowner uncovered a 3-inch common round that was serendipitously found adjacent to the Cerro Balcon access road.

4.1.04 A total of 94 grids and subgrids were cleared of surface MEC and issued Form 948s by the CEHNC on-site representative. At the Cerro Balcon site, 46 grids totaling approximately 23.9 acres were completed. On Cayo Lobo, 48 grids totaling approximately 11.2 acres were completed.

4.1.05 A total of 58 MEC items were located, demilled, and disposed of during the field operations, including 10 from the Cerro Balcon site (two fuzes, five projectiles, and three mortars) and 48 from the Cayo Lobo search area. Forty-one of those were BDU33 25-pound practice bombs. Additional MEC included one BDU33 signal cartridge, four MK106 5-pound practice bombs, one M151 fuze, and one 5-inch 54 MK41 projectile.

4.1.06 The occurrence of the 3-inch rounds at Cerro Balcon was not expected based on the original ASR or SASR, although the SASR indicated that Cerro Balcon had been in the artillery firing range safety fan. Given that 3-inch rounds comprised 50 percent of the MEC located at Cerro Balcon, it seems likely that those rounds may be relatively widespread in the local area.

## 4.2 Environmental Sampling

Soil samples were collected in accordance with the Sampling and Analysis Plan (Appendix E of the Final Work Plan) (EEG 2006). EEG used the United States Army Cold Regions Research and Engineering Laboratory (CRREL) 7-sample wheel approach to ensure representative sample collection. The chemical data will be evaluated as part of a comprehensive remedial investigation of Culebra.

## 4.3 Field Effort Costs

REPORT DATE: 08/08/07 13:03
PERIOD ENDING: 07/27/07
CLIENT: USAESC, HUNTSVILLE
CONTRACT NAME: CULEBRA REMOVAL ACTION

| Labor Category Code | Category | Rate | Total Units Incurred Per Task | | | Total Hours | Total Cost |
|---|---|---|---|---|---|---|---|
| | | | Task 0300 (Hrs) | Field Effort Task 0400 (Hrs) | Env Sampling Task 0700 (Hrs) | | |
| AC | ADMIN/CLERK | $29.55 | 36.4 | | | 36.4 | $1,075.62 |
| A2 | ADMIN/CLERK YR2 | $41.12 | 8.2 | 1,180.1 | 11.0 | 1,199.3 | $49,315.22 |
| A3 | ADMIN/CLERK YR3 | $42.76 | | 59.0 | | 59.0 | $2,522.84 |
| S7 | CHEMIST YR2 | $61.92 | | 144.0 | 27.5 | 171.5 | $10,619.28 |
| GG | GEOLOGIST | $59.85 | 151.5 | | | 151.5 | $9,067.28 |
| G4 | GEOLOGIST YR2 | $62.25 | 0.5 | 199.8 | | 200.3 | $12,468.68 |
| G2 | GIS TEC YR2 | $61.88 | | 81.5 | | 81.5 | $5,043.22 |
| G3 | GIS TECH YR3 | $64.34 | 3.0 | 5.5 | | 8.5 | $546.89 |
| PM | PROJECT MANAGER | $70.79 | 14.0 | 9.0 | | 23.0 | $1,628.17 |
| P2 | PROG MGR YR2 | $130.55 | 38.0 | 172.0 | | 210.0 | $27,415.50 |
| M2 | PROJ MGR YR2 | $73.60 | 19.0 | 645.5 | | 664.5 | $48,907.20 |
| M3 | PROJ MGR YR3 | $76.54 | 4.0 | 11.0 | | 15.0 | $1,148.10 |
| BJ | SECURITY GUARD YR2 | $23.78 | | 6,302.0 | | 6,302.0 | $149,861.56 |
| SM | SITE MANAGER | $62.68 | 11.5 | 1,118.0 | 56.0 | 1,185.5 | $74,307.14 |
| S2 | SITE MGR YR2 | $65.18 | | 698.0 | 8.0 | 706.0 | $46,017.08 |

| Labor Category Code | Category | Rate | Total Units Incurred Per Task | | | Total Hours | Total Cost |
|---|---|---|---|---|---|---|---|
| | | | Task 0300 (Hrs) | Field Effort Task 0400 (Hrs) | Env Sampling Task 0700 (Hrs) | | |
| S3 | SITE MGR YR3 | $67.77 | 21.5 | 138.5 | | 160.0 | $10,843.20 |
| X2 | SR UXO SUP YR2 | $93.51 | | 1,015.0 | | 1,015.0 | $94,912.65 |
| X3 | SR UXO SUP YR3 | $97.15 | | 98.5 | | 98.5 | $9,569.28 |
| H2 | SR UXO SUP 4% YR2 | $97.15 | | 134.0 | | 134.0 | $13,018.10 |
| H3 | SR UXO SUP 4% YR3 | $100.94 | | 12.0 | | 12.0 | $1,211.28 |
| H4 | SR UXO SUP 8% YR2 | $100.77 | | 557.0 | | 557.0 | $56,128.89 |
| H5 | SR UXO SUP 8% YR3 | $104.70 | | 26.0 | | 26.0 | $2,722.20 |
| E3 | TECH II YR2 | $47.72 | 90.0 | 364.1 | | 454.1 | $21,669.65 |
| TW | TECHNICAL WRITER | $39.55 | 13.5 | | | 13.5 | $ 533.93 |
| W2 | TECH WRITER YR2 | $41.12 | 3.5 | 11.7 | | 15.2 | $625.02 |
| Q4 | UXO SAFE/QC YR2 | $79.34 | | 850.9 | | 850.9 | $67,510.41 |
| Q5 | UXO SAFE/QC OFF YR3 | $82.43 | | 71.6 | | 71.6 | $5,901.99 |
| Q6 | UXO SAFE/QC 4% YR2 | $82.43 | | 122.0 | | 122.0 | $10,056.46 |
| Q9 | UXO SAFE/QC 4% YR3 | $85.61 | | 6.8 | | 6.8 | $582.15 |
| Z1 | UXO SAFE/QC 8% YR2 | $85.48 | | 796.1 | | 796.1 | $68,050.63 |
| Z2 | UXO SAFE/QC 8% YR3 | $88.79 | | 44.1 | | 44.1 | $3,915.64 |
| E1 | UXO SWEEP TEC YR2 | $44.92 | | 1,724.5 | 6.0 | 1,730.5 | $77,734.06 |
| E2 | UXO SWEEP TEC YR3 | $46.61 | | 173.5 | | 173.5 | $8,086.84 |
| D4 | UXO TEC I YR2 | $44.92 | | 1,384.4 | | 1,384.4 | $62,187.25 |
| D5 | UXO TEC I YR3 | $46.61 | | 96.6 | | 96.6 | $4,502.53 |
| D6 | UXO TEC I 4% YR2 | $46.61 | | 71.5 | | 71.5 | $3,332.62 |
| D7 | UXO TEC I 4% YR3 | $48.37 | | 3.0 | | 3.0 | $145.11 |
| D8 | UXO TEC I 8% YR2 | $48.30 | | 1,720.9 | | 1,720.9 | $83,119.47 |
| D9 | UXO TEC I 8% YR3 | $50.12 | | 76.4 | | 76.4 | $3,829.17 |
| T3 | UXO TECH II | $56.78 | | -3.5 | | -3.5 | ($198.73) |
| C7 | UXO TEC II YR2 | $58.95 | | 2,152.7 | | 2,152.7 | $126,901.67 |
| C8 | UXO TEC II YR3 | $61.19 | | 85.2 | | 85.2 | $5,213.39 |
| C9 | UXO TEC II 4% YR2 | $61.19 | | 155.0 | | 155.0 | $9,484.45 |
| D1 | UXO TEC II 4% YR3 | $63.55 | | 2.0 | | 2.0 | $127.10 |
| D2 | UXO TEC II 8% YR2 | $63.44 | | 2,019.7 | | 2,019.7 | $128,129.77 |
| D3 | UXO TEC II 8% YR3 | $65.87 | | 79.3 | | 79.3 | $5,223.49 |
| C1 | UXO TECH III YR2 | $70.14 | | 1,243.5 | | 1,243.5 | $87,219.09 |
| C2 | UXO TEC III YR3 | $72.85 | | 113.8 | | 113.8 | $8,290.33 |
| C3 | UXO TEC III 4% YR2 | $72.85 | | 83.0 | 3.8 | 86.8 | $6,323.38 |

| Labor Category Code | Category | Rate | Total Units Incurred Per Task | | | Total Hours | Total Cost |
|---|---|---|---|---|---|---|---|
| | | | Task 0300 (Hrs) | Field Effort Task 0400 (Hrs) | Env Sampling Task 0700 (Hrs) | | |
| C4 | UXO TEC III 4% YR3 | $75.65 | | 4.5 | | 4.5 | $340.43 |
| C5 | UXO TEC III 8% YR2 | $75.54 | | 1,328.6 | | 1,328.6 | $100,362.44 |
| C6 | UXO TEC III 8% YR3 | $78.46 | | 67.7 | | 67.7 | $ 5,311.74 |

| | Task 0300 (Hrs) | Field Effort Task 0400 (Hrs) | Env Sampling Task 0700 (Hrs) | Total Cost |
|---|---|---|---|---|
| TOTAL LABOR | 414.6 | 27,456.0 | 112.3 | $1,532,860.81 |
| MATERIALS / EQUIPMENT | $10,171.48 | $510,234.96 | $39,881.38 | $560,287.82 |
| TRAVEL | $1,852.04 | $427,814.62 | $57.00 | $429,723.66 |
| SUBCONTRACTOR | $20,137.00 | $244,281.11 | $ – | $264,418.11 |
| TOTAL | | | | $2,787,290.40 |

# 5.0 Conclusions

5.0.01 The concentration of MEC locations at the Cerro Balcon site appears to confirm the primary target area, at the base of Cerro Balcon, identified in the ASR. The entire range fan of the mortar range, as drawn in the ASR, encompassed an area of approximately 158 acres, including Cerro Balcon, and was drawn past the top of Cerro Balcon. The discovery of 3-inch common rounds and an MK14 suggests that, in addition to being used as a mortar range, as identified in the ASR, Cerro Balcon might also have been used as a target for gunnery practice. The SASR identified Cerro Balcon as falling within the historic safety fan of the artillery firing range. The discovery of gunnery rounds at Cerro Balcon confirms the SASR findings. The fact that MEC was located outside the boundaries of the initial search grids area suggests that MEC would be more widespread in the general Cerro Balcon area, and again confirms the findings of the SASR that the military utilized most of Culebra during training exercises.

5.0.02 The 3-inch common round (CBH08001) found on the southern flank of Cerro Balcon was located only following land clearing by the property owner. Given the indication that MEC is more widespread in the general area than it was initially believed to be, more land clearing and development of the Cerro Balcon area is likely to uncover additional MEC and to present a potential hazard to property owners.

5.0.03 The EE/CA report (ESE 1996) noted that the density of ordnance-related debris at Cerro Balcon was greatest along the fence line. A conversation with a long-time resident of Culebra indicated that when ordnance items were found in the past (when the area was utilized as a cattle ranch), the range hands would bury them along the fence lines.

5.0.04 The non-random distribution of MEC on Cayo Lobo indicated that the flight line of aircraft across the cay was generally from the south-southwest to the north-northeast. The greatest density of MEC—17 items within 0.92 acres—was located in grid CLC08. MEC density rapidly decreased away from grid CLC08. MEC density in the western portion of the search area was greatly reduced (less than one item per acre). It appears that the grids that were investigated during the 1995 EE/CA straddled the area of greatest MEC density. No grids on Cayo Lobo to the east of the 08 line of grids were searched. It seems likely that the 09 grid line would contain some MEC.

5.0.05 The significant chemical data collected during this removal action will be further evaluated in a remedial investigation report. The report will evaluate all chemical data for Culebra Island and the surrounding cays.

# 6.0 References

Ellis Environmental Group, LC (EEG), 2006. Final Work Plan, Non-Time-Critical Removal Action, Municipality of Culebra, Puerto Rico.

Environmental Science and Engineering (ESE), 1996. Engineering Evaluation / Cost Analysis at the Culebra National Wildlife Refuge, Puerto Rico.

Environmental Science and Engineering (ESE), 1997. Engineering Evaluation / Cost Analysis Action Memorandum at the Culebra National Wildlife Refuge, Puerto Rico.

ReForesta, 2006a. Flora and Fauna Survey for Cayo Lobo, DERP-FUDS Clean Up, Culebra, Puerto Rico.

ReForesta, 2006b. Flora and Fauna Survey for Culebrita Island, DERP-FUDS Clean Up, Culebra, Puerto Rico.

Southeastern Archaeological Research, Inc. (SAR), 2006a. Archaeological Walkover Survey Associated with Unexploded Ordnance Removal, Cerro Balcon, Isla de Culebra, Puerto Rico.

Southeastern Archaeological Research, Inc. (SAR), 2006b. Archaeological Walkover Survey Associated with Unexploded Ordnance Removal on Isla Culebrita and Cayo Lobo, Municipality of Culebra, Puerto Rico.

United States Army Corps of Engineers (USACE), Rock Island District, 1995. Archives Search Report Findings for Culebra Island National Wildlife Refuge, Culebra Island, Puerto Rico.

United States Army Corps of Engineers (USACE), St. Louis District, 2005. Defense Environmental Restoration Program for Formerly Used Defense Sites Military Munitions Response Program Supplemental Archives Search Report, Culebra, Puerto Rico.