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# **Phase III Engineering Evaluation/Cost Analysis Work Plan**

## **Former Waikoloa Maneuver Area Island of Hawaii, Hawaii**

**Contract No. DACA87-00-D-0036**

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**LIMITATIONS AND INTERNAL DOCUMENT APPROVAL**

**Limitations:**

USA Environmental, Incorporated (USA) has prepared this Phase III Engineering Evaluation/Cost Analysis (EE/CA) Work Plan for the former Waikoloa Maneuver Area, Island of Hawaii, Hawaii, in accordance with principles and practices generally employed in the environmental consulting profession.

USA based the technical approach provided in this EE/CA Work Plan on data and literature provided by government sources, USA experience in performing similar tasks, and information obtained during the Geophysical Prove-Out, site visits, and Technical Project Planning meeting. USA accepts information developed by government agencies and independent contractors to be authentic and true as stated, unless otherwise noted. The technical approaches are subject to change based upon receipt of new information regarding the potential presence or evidence of OE, critical environmental habitats, historical/cultural features, and other factors potentially impacting the safe and efficient investigation of the Phase III EE/CA sectors.

**Approvals:**

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**LIST OF ACRONYMS**

AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
ATF	Bureau of Alcohol, Tobacco, and Firearms
CADD	Computer Aided Design and Drafting
CAR	Corrective Action Report
CD	Compact Disc
CERCLA	Comprehensive Environmental Restoration, Compensation, and Liability Act
CSM	Conceptual Site Model
CWA	Clean Water Act
CWM	Chemical Warfare Materiel
DDESB	Department of Defense Explosive Safety Board
DEI	Donaldson Enterprises, Incorporated
DERP	Defense Environmental Restoration Program
DGM	Digital Geophysical Mapping
DGPS	Digital Global Positioning System
DID	Data Item Description
DLNR	Department of Land and Natural Resources
DoD	Department of Defense
DOT	Department of Transportation
DQO	Data Quality Objective
DRMO	Defense Reutilization and Marketing Office
EE/CA	Engineering Evaluation/Cost Analysis
EM	Electromagnetic
EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act
FAR	Federal Acquisition Regulations
FFP	Firm Fixed Price
FUDS	Formerly Used Defense Site
GFE	Government Furnished Equipment
GIS	Geographical Information System
GPO	Geophysical Prove-Out
GPS	Global Positioning System
HAZWOPER	Hazardous Waste Operations

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HE	High Explosives
IDW	Investigation Derived Waste
ITP	Instrument Test Plot
MBTA	Migratory Bird Treaty Act
MFR	Memorandum for Record
MGFD	Munition with Greatest Fragmentation Distance
MOFB	Miniature Open Front Barricade
MSD	Minimum Separation Distance
NAD	North American Datum
NAVD	North American Datum
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDAI	No Department of Defense Action Indicated
NHPA	National Historic Preservation Act
NTCRA	Non-Time Critical Removal Action
NTP	Notice to Proceed
OE	Explosive Ordnance
OERIA	Ordnance and Explosive Risk Impact Assessment
PAO	Public Affairs Officer
PC	Personal Computer
PDA	Personal Data Assistant
PDOP	Precision Dilution of Precision
PLS	Professional Land Surveyor
PMP	Property Management Plan
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
RAB	Restoration Advisory Board
RAM	Random Access Memory
RCWM	Recovered Chemical Warfare Materiel
ROM	Read Only Memory
RTK	Real Time Kinematic
SHPO	State Historic Preservation Officer
SOP	Standard Operating Procedure
SOW	Scope of Work

SSHP	Site Safety and Health Plan
SUXOS	Senior Unexploded Ordnance Supervisor
TBD	To Be Determined
TCRA	Time Critical Removal Action
TPP	Technical Project Planning
USA	USA Environmental, Incorporated
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville
USFWS	U.S. Fish and Wildlife Service
UTM	Universal Transverse Mercator
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer
Wil Chee	Wil Chee Planning, Incorporated

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## 1. INTRODUCTION

### 1.1 PROJECT AUTHORIZATION

The U.S. Army Engineering and Support Center, Huntsville (USAESCH) and the U.S. Army Corps of Engineers (USACE), Honolulu District tasked USA Environmental, Incorporated (USA) to conduct the ordnance and explosives (OE) Engineering Evaluation/Cost Analysis (EE/CA) of the former Waikoloa Maneuver Area, Island of Hawaii, Hawaii (Project No. H09HI035902). As a result of former Department of Defense (DoD) ownership and use, OE potentially exists at the former Waikoloa Maneuver Area and constitutes a safety risk to human health. The EE/CA serves to characterize potential OE risks and develop appropriate response alternatives to reduce human health risks associated with OE items.

USA will perform the EE/CA in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Sections 104 and 121; Executive Order 12580; the National Oil and Hazardous Substances Pollution Contingency Plan (NCP); and the Code of Federal Regulations Part 29, Subpart 1910.120. In addition, USA will perform all work activities in areas potentially containing unexploded ordnance (UXO) hazards in full compliance with USAESCH, USACE, Department of the Army, and DoD requirements regarding personnel, equipment, and procedures.

USA will perform the EE/CA under the Defense Environmental Restoration Program (DERP) Formerly Used Defense Site (FUDS) Program, using relevant U.S. Army guidance for OE programs. USA will complete all tasks detailed in the Statement of Work (SOW) under Contract No. DACA87-00-D-0036, Delivery Order No. 0016.

USA prepared this EE/CA Work Plan to define the data collection efforts of the EE/CA phase of the Non Time Critical Removal Action (NTCRA) process. This Work Plan is an addendum to the *Master Work Plan for Engineering Evaluation/Cost Analysis Former Waikoloa Maneuver Area - Parker Ranch Area Kamuela, Island of Hawaii, Hawaii* (Earth Tech, 1997). It is intended to be used in conjunction with the *Master Work Plan* and may not be used as an independent document.

### 1.2 PURPOSE AND SCOPE

The purposes of the EE/CA is to establish methods for identifying remnant OE at the former Waikoloa Maneuver Area; identify potential human health risks associated with the remnant OE; and identify, evaluate, and recommend response alternatives that reduce the human health risks associated with OE. The purpose of this Work Plan is to define the goals, methods, procedures, and personnel responsibilities that guide the data collection efforts for the Phase III EE/CA.

During the Phase I EE/CA, the USACE conducted field investigations in six designated areas within the former Waikoloa Maneuver Area (primarily within the active Pu'u Pa Maneuver Area) totaling approximately 521 acres. Upon review of the Phase I EE/CA data, the USACE identified additional areas for investigation under the Phase II EE/CA. The Phase II EE/CA investigation areas encompassed 93,343 acres and field investigations involved the excavation of anomalies identified by geophysical investigation within randomly placed sampling grids and meandering paths. The field investigation team recovered 38 UXO items, 2,160 OE scrap items, and 1,343 small arms rounds during the Phase II EE/CA efforts. Based on the finding of the Phase II EE/CA, the USACE identified three areas for OE investigation in the Phase III EE/CA of the former Waikoloa Maneuver Area, two of which were identified for investigation under the Phase II EE/CA. These areas include:

- 
- Sector 15 – Hawaiian Homelands Area (Sector 8 in Phase II EE/CA, 11,070 acres in the northeastern portion of the former Waikoloa Maneuver area previously excluded from investigation due to Rights-of-Entry constraints)
  - Sector 16 – Area North of Kawaihae Road (3,000 acres north of the Kawaihae Road Area)
  - Sector 17 – Area West of Queen Kaahumanu Highway (Sector 11 in Phase II EE/CA, 2,500 acres west of Queen Kaahumanu Highway previously excluded from investigation due to Rights-of-Entry constraints)

The scope of this EE/CA is limited to OE characterization and evaluations of human health risks associated with the explosive hazards of remnant OE that may be present within approximately 16,600 acres of the Phase III EE/CA project site.

### 1.3 WORK PLAN ORGANIZATION

USA prepared this Work Plan as an addendum to the *Master Work Plan* for the EE/CA of the former Waikoloa Maneuver Area. It is intended to be used in conjunction with the *Master Work Plan* and may not be used as an independent document. The format of this addendum to the *Master Work Plan* is described below:

**Chapter 1.0: Introduction** discusses the project authorization, defines the purpose and scope of the EE/CA, and provides a brief history and description of the former Waikoloa Maneuver Area, including its former military use, previous site investigations performed at the site, and the types of ordnance reported used and recovered during previous investigations and removal actions.

**Chapter 2.0: Technical Management Plan** defines the project objectives, project team roles and responsibilities, and general organizational and operational procedures.

**Chapter 3.0: Field Investigation Plan** defines the approach to the data collection efforts outlined in the SOW for the Phase III EE/CA, including identification of characterization goals and Data Quality Objectives (DQOs), identification of Areas of Concern (AOC), and procedures for geophysical and intrusive OE investigations.

**Chapter 4.0: Quality Control Plan** defines the control measures to be implemented to ensure that data collection efforts meet the quality objectives established by USAESCH and USA corporate standards.

**Chapter 5.0: Explosives Management Plan** provides details for management of explosives at the project site in accordance with applicable regulations.

**Chapter 6.0: Explosive Siting Plan** provides explosives safety criteria for planning and siting explosives operations at the project site.

**Chapter 7.0: Environmental Protection Plan** identifies the preliminary Applicable or Relevant and Appropriate Requirements (ARARs) for the Phase III EE/CA field investigations necessary to protect potentially impacted sensitive species and habitats and the overall environment at the project site.

**Chapter 8.0: Property Management Plan** describes how property management will be performed at the project site.

**Chapter 9.0: References** provides an inventory of the reference materials used in the preparation of this addendum to the *Master Work Plan*.

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Appendices to this addendum to the *Master Work Plan* include;

**Appendix A: Scope of Work**

**Appendix B: Site Map**

**Appendix C: Local Points of Contact**

**Appendix D: Site Safety and Health Plan**

**Appendix E: Environmental Sampling and Analysis Plan (Not required for this project)**

**Appendix F: Draft Geophysical Prove-Out Letter Report**

**Appendix G: Minimum Separation Distances Calculation Sheets**

**Appendix H: Resumes**

**Appendix I: Technical Project Planning Work Sheets**

**Appendix J: Forms**

#### 1.4 PROJECT LOCATION

The former Waikoloa Maneuver Area is approximately 91,000 acres in size and located on the western side of the Big Island of Hawaii, Hawaii (Figure 1-1). The former maneuver area rests on a slope surrounded by three of the five shield volcanoes that compose the Island of Hawaii. On the north is Kohala Mountain, the oldest volcanic feature on the island. On the southwest is the Hualalai Cone and Crater, and on the east is Mauna Kea. Coastal land bounds the maneuver area on the west.

The former Waikoloa Maneuver Area is approximately 30 miles north of the city of Kailua-Kona in the South Kohala District. The former maneuver area is bordered by Queen Kaahumanu Highway (State Highway 19) on the west, the South Kohala/North Kona District boundary line to the south, the South Kohala/Hamakua District boundary line to the east, and Kawaihae Road to the north.

The Phase III EE/CA project site consists of 3 sectors that border the original boundary of the former Waikoloa Maneuver Area. These sectors include:

- Sector 15 (Hawaiian Homelands Area), previously Sector 8 in Phase II EE/CA, this area consists of 11,070 acres in the northeastern portion of the former Waikoloa Maneuver area, southeast of Waimea.
- Sector 16 (Northern Kawaihae Road Area) consists of 3,000 acres to the north of the Kawaihae Road, north of the Kawaihae Road Area (Sector 9) previously investigated in the Phase II EE/CA, west of Waimea.
- Sector 17 (Area West of Queen Kaahumanu Highway) consists of 2,500 acres to the west of former Waikoloa Maneuver Area, across the Queen Kaahumanu Highway.

#### 1.5 SITE DESCRIPTION

The former Waikoloa Maneuver Area is located on the rolling upland slopes of ancient basaltic lava flows, now covered with grassland vegetation. These upland slopes are cut by widely spaced erosional gullies. Soil types within the maneuver area are largely shallow, dry, and/or

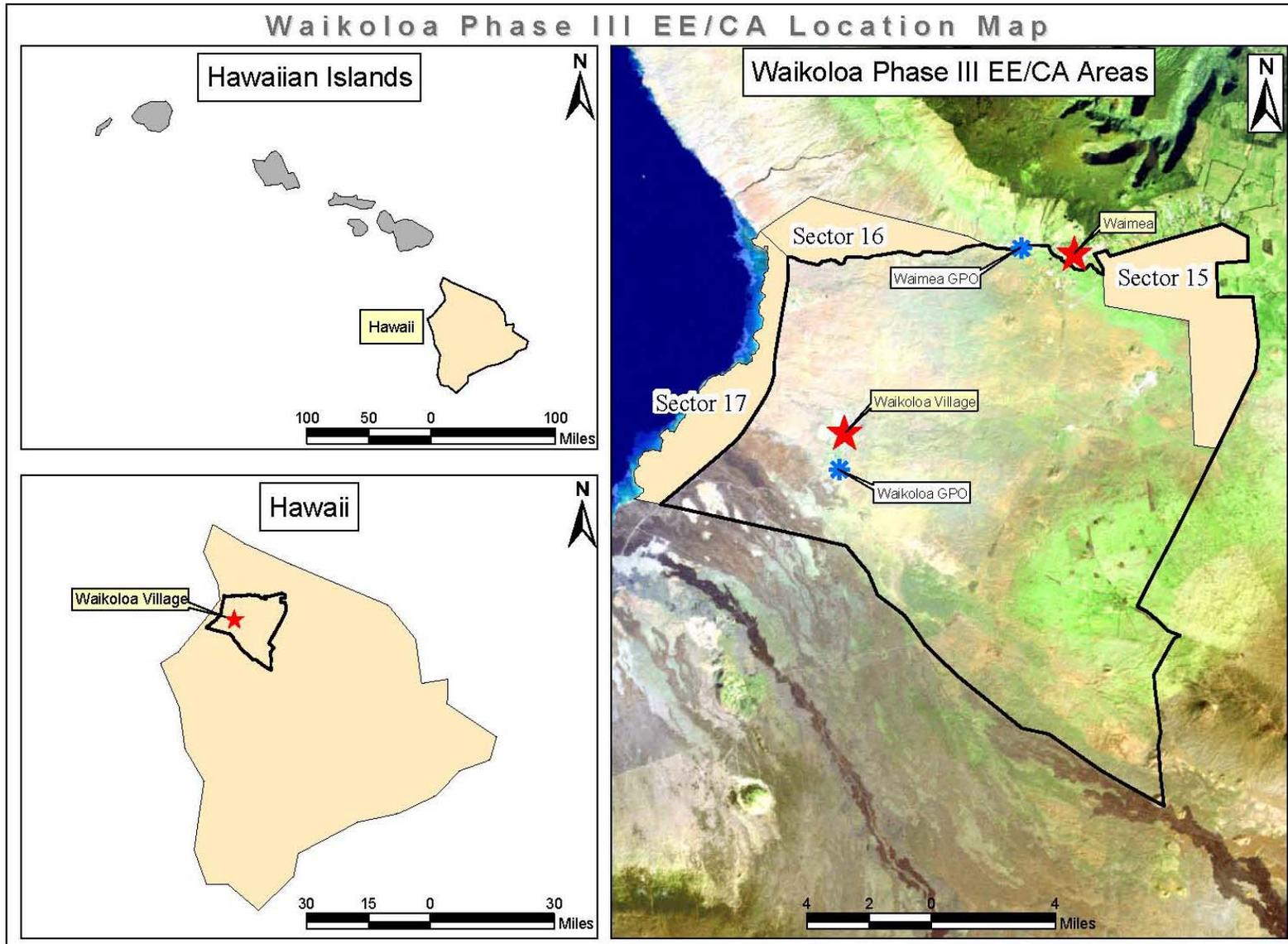


Figure 1-1. Location of Former Waikoloa Maneuver Area

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stony, and are subject to aeolian (windblown) conditions leaving a thin veneer of silt loam as top soil. These soil conditions, along with the semiarid climate, lend itself to large expanses of grassland along with sparse stands of vegetation, including cactus and eucalyptus trees.

Among the prominent landforms in the former Waikoloa Maneuver Area, are ancient cinder cones. Pu'u Pa cinder cone rises approximately 300 feet (elevation 2,667 feet mean sea level) above the pastureland west of Mamalahoa Highway, while to the east of Mamalahoa Highway is Holoholoku cinder cone, which rises approximately 350 feet (elevation 3,265 feet mean sea level) above the mildly sloping grasslands.

#### 1.5.1 TOPOGRAPHY

The rolling terrain characteristic of the former maneuver area encompasses two physiographic landforms; slightly dissected uplands and lava plains. The upland area of the slope is cut by widely spaced gullies formed by erosion, while the lava plains are broad with little topographic relief. The lava areas are pocked and scarred by lava blisters and stacks formed by gas pockets rupturing the surface and breaking the lava crust. Caves and lava tubes are prevalent in these areas.

From its coastal origin in the west, the former maneuver area rises eastward up the slope of Mauna Kea to a height of approximately 5,500 feet above mean sea level. Except at its easternmost boundary, the slope of the land is less than 10 percent .

Among the prominent landforms in the former maneuver area are ancient cinder cones. Puu Pa cinder cone rises approximately 300 feet (elevation 2,667 feet mean sea level) above the pastureland west of Mamalahoa Highway. To the east of Mamalahoa Highway is Holoholoku cinder cone, which rises approximately 350 feet (elevation 3,265 feet above mean sea level) above the mildly sloping grasslands. South of the intersection of Mamalahoa Highway and Saddle Road is the Nahonaohae Puu. This puu and the surrounding area is a conservation area for native Hawaiian plants. South of Waikoloa Road is Puu Hinai, a cinder cone approximately 1 mile southeast of Waikoloa Village.

#### 1.5.2 SURFACE WATER

There are no permanent watercourses in the vicinity of the former maneuver area due to the low level of annual precipitation. Waikoloa Creek and other minor watercourses are seasonal, flowing only during the rainy season (typically November through April) and at times subject to occasional flash flooding. Sheet wash (or sheet flooding) is known to occur in down slope areas throughout the former maneuver area and is considered a high energy event that causes soil movement, rock movement, and may potentially expose subsurface ordnance that may lie close to the surface.

#### 1.5.3 CLIMATE

Due to the large size and varied elevation (i.e., sea level to 5,500 feet above mean sea level) of the former maneuver area, several climatic zones are present. At the westernmost boundary where the former maneuver area nears the Pacific Ocean, the climate is classified as a hot desert. As the land rises eastward up the slope of Mauna Kea, the former maneuver area is transected by a band of hot, semi-desert conditions that terminate at its far eastward reach in a summer-dry, warm temperate climate. Temperatures within the former maneuver area range from the high 90s to the low 50s (in degrees Fahrenheit).

The leeward position of the former maneuver area, in the rain shadow of Mauna Kea, makes it one of the drier regions in Hawaii. Precipitation throughout the former maneuver area ranges between 10 and 20 inches per year.

The wind patterns of the State of Hawaii are characterized by northeasterly trade winds generated by a high-pressure center north of the islands. These winds are generally strongest during the summer and are periodically disrupted by storms in the winter. Within the former maneuver area, the trade wind force normally has a diurnal variation caused by differential rates of cooling and heating of the land. Light winds predominate during the morning hours, and strong steady winds (15 to 30 miles per hour) occur throughout the rest of the day. Wind erosion is common in areas with loose, dry soils.

#### 1.5.4 VEGETATION

The presence of plant species within the former maneuver area is closely related to elevation and climatic factors (e.g., temperature, rainfall). Vegetation at the former maneuver area is generally classified as Coastal Dry Communities consisting of dry grasslands, dry shrublands, and dry forests and Lowland Dry Communities consisting of fountain grass grasslands and remnants of native Hawaiian forests (Palmer and Paul, 1999). The primary pasture grasses are buffelgrass and fountain grass. Eucalyptus is present in a grove and along the southerly base of Puu Pa. Random stands of cactus are present throughout the former maneuver area.

In 1997, a flora and fauna survey of the former maneuver area was conducted by Wil-Chee Planning, Inc. (Wil Chee) (USACE, 1997). Areas in the north-central region of the former maneuver area were recorded as having been intensely impacted by grazing and a variety of anthropogenic stresses; therefore, these areas are poor habitats for endangered plants. The Parker Ranch pasturage in this area exhibited relative homogeneity throughout with regard to topography and plant species variation and did not contain refuges or zones inaccessible to grazing livestock. During this survey, only one endangered plant or plant species of concern was discovered by the project botanists. Thirty-four individual plants of *Portulaca sclerocarpa* were found on Puu Pa scattered from the base of the Puu to just below its summit.

The most significant vegetation feature in the project area is an approximately 20 square kilometer area of native Kawelu Grassland, which extends between Kamakoa Gulch to Waiulaula Gulch and west from the rock wall to the coast. The Kawelu Grassland may support native and endangered plant species in normal rainfall years. The majority of the vegetation on the project area is nonnative grasslands (Palmer and Paul, 1999).

Several rare Hawaiian plant species were observed on the former maneuver area near Waikoloa Village. These species include nehe (*Lipochaeta lavarum*), kaunaoa (*Cuscuta sandwichiana*), iliahi (*Santalum ellipticum*), and akia (*Wikstroemia pulcherima*) (Palmer and Paul, 1999).

*Portulaca sclerocarpa*, a federally listed endangered plant or species of concern, was found to occur within the central region of the former maneuver area. The species was found growing as a low or prostrate herb with one to several stems, 10 to 20 centimeters long. It was typically observed on rock microsites between *Pennisetum setaceum* and in proximity to *Portulaca pilosa* plants (USACE, 1997). Palmer and Paul identified *Portulaca sclerocarpa* in the Lalamilo area during their 1999 botanical

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survey of the project area. The Puako parcel supports a population of endangered flowering maple (*Abutilon menziesii* Seem.) (USACE, 1996).

#### 1.5.5 GEOLOGY AND SOILS

The former maneuver area is situated on rolling upland slopes of ancient basaltic lava flows that are now covered with grassland vegetation and cut by widely spaced erosional gullies. The former maneuver area is surrounded by three of the five shield volcanoes that compose the Island of Hawaii; on the north are the Kohala Mountains, the oldest volcanic feature on the island; on the southwest are the Hualalai Cone and Crater; and on the east is Mauna Kea. Coastal land bounds the former maneuver area on the west.

The majority of the former maneuver area lies within the Waimea Plains. The plains were formed by Mauna Kea lava flows that ponded against the older Kohala Mountains and are now covered with volcanic ash-type soils. The interior plains at Pohakuloa are covered with more recent lava flows from Mauna Loa that banked against Mauna Kea. The lava is predominantly basalt flows and scoria of the Hamakua Volcanics. These rocks, like all Hawaiian basalts, are extremely iron rich (Wolfe and Morris, 1996). The composition of some basalt rocks exceeds 40 percent iron minerals. This high iron content cause geophysical "false alarms" in the detection of subsurface ordnance (also iron rich). Not only will the geophysical equipment detect ferrous ordnance, it will also detect iron rich basalt cobbles, sub-crops, or changes in the iron composition from one lava flow to the next, depending on its iron content. Basalt, because of its iron rich composition, will oxidize and weather similar to that of oxidized ordnance. Consequently, there can be difficulty in visually discriminating ordnance from oxidized basalt lava flows. In areas where volcanic flows have not recently occurred, the terrain is eroded by seasonal rivers and streams. In other areas, the terrain is undissected and quite barren, revealing a large area of exposed lava (U.S. Department of Agriculture, 1973).

Soil types within the project area are largely shallow, dry, and/or stony, and are subject to aeolian (wind-blown) conditions leaving a thin veneer of silt loam as a top soil. These soil conditions, along with the semiarid climate, lend itself to large expanses of grassland along with sparse stands of vegetation, including cactus and eucalyptus trees.

According to the Natural Resources Conservation Service, the soils within the former maneuver area can be classified into one of three soil associations: the Kawaihae Association, the Puu Pa-Pakini-Waiaha Association, and the Waimea-Kikoni-Naalehu Association.

The Kawaihae Association consists of moderately deep, gently sloping to moderately steep, somewhat excessively drained soils that have medium textured subsoil that form in volcanic ash. These soils are found in the west one-third of the former maneuver area (the coastal plains) and extend inland from near sea level to approximately 1,500 feet above mean sea level. Kawaihae soils have a surface layer of dark reddish-brown and dusky-red silt loam. Bedrock is at a depth of approximately 10 to 40 inches below ground surface (U.S. Department of Agriculture, 1973).

Puu Pa-Pakini-Waiaha Association soils make up the central one-third of the former maneuver area and consist of shallow to deep, nearly level to steep, well drained to somewhat excessively drained soils that have a medium-textured subsoil or underlying material. These upland soils occur at elevations up to 4,000 feet above mean sea level and have a concentration of calcium carbonate that occurs as a soil layer or as coatings on rock fragments. Also formed of volcanic ash, these soils have

a very dark brown, extremely stony, very fine sandy loam surface layer. Their subsoil is dark brown and dark yellowish-brown, very stony, very fine sandy loam, and can range from 20 to 55 inches below ground surface (U.S. Department of Agriculture, 1973).

The easternmost one-third of the former maneuver area is characterized by Waimea-Kikoni-Naalehu Association soils. These volcanic ash soils are very deep, nearly level to steep, well drained, and have a medium-textured to moderately fine-textured subsoil. The soils have a dark surface layer that is high in content of organic matter; they occur at elevations ranging from 750 feet to 6,000 feet above mean sea level (U.S. Department of Agriculture, 1973). Depending upon the location and amount of rainfall, the soil types within the former maneuver area are able to support pastureland and farming of various crops. The remaining areas support habitat for wildlife.

#### 1.5.6 PHASE I ENGINEERING EVALUATION/COST ANALYSIS AREAS

The following is a physical description of the five areas (A, B, C, E, and F) identified for inclusion in the Phase I EE/CA field investigation (Figure 1-2):

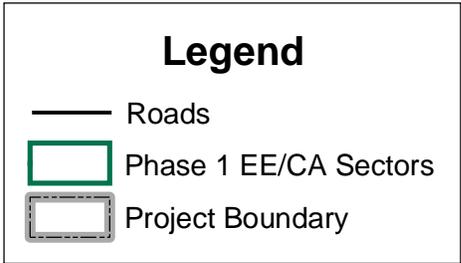
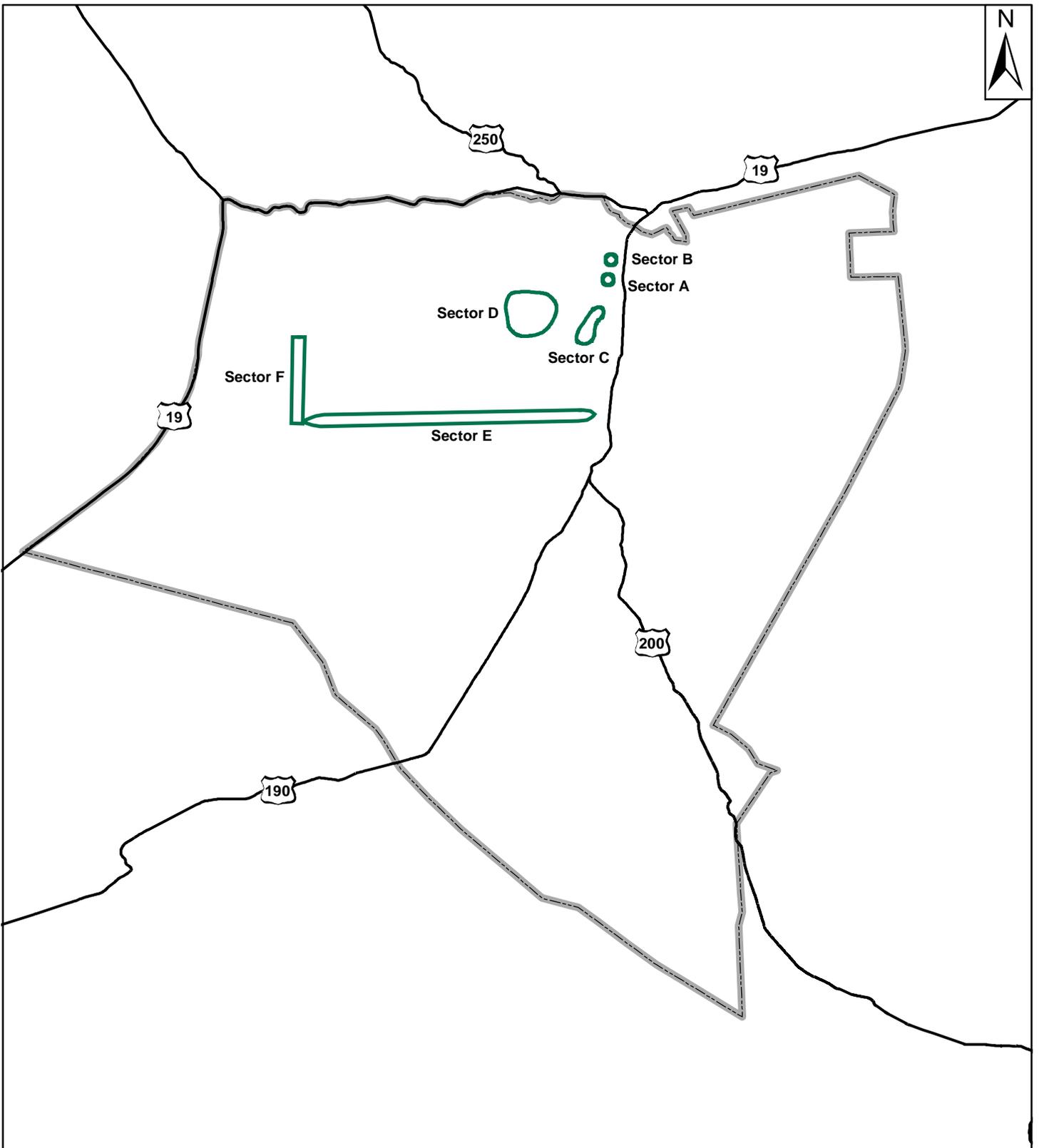
**Area A** - This parcel, located near Gary's Automotive, is approximately 60 acres in size and is scheduled to be the future location of the Kamuela Industrial Park. The topography of this area is relatively flat and has fairly sparse vegetation. The proximity of Area A to Mamalahoa Highway should allow easy access for project field teams. Unfortunately, its proximity to Mamalahoa Highway may also pose problems with regard to road closures if ordnance items are found and must be disposed of in-place.

**Area B** - This parcel is referred to as the "tree plot," and is approximately 30 acres in size. This site is also relatively flat; however, there is a moderate stand of eucalyptus trees throughout the area. Cactus plants are present in lesser numbers. Area B is also adjacent to Mamalahoa Highway, which may present problems if ordnance items are found and road closures are implemented.

**Area C** - This parcel is approximately 15 acres in size and referred to as the wastewater treatment plant expansion area. The area is relatively flat and appears to have been graded. Therefore, the area has significantly less vegetation than the surrounding pastures where cattle graze. To access this site, vehicles must pass through gated areas where livestock gather. Dirt roads leading into this site are capable of generating substantial fugitive dust if vehicular speeds are not kept below 15 miles per hour.

**Area E** - This 75-acre site follows a fence line that runs nearly perpendicular to Mamalahoa Highway in a westerly direction. The site, which is assumed to be 50 feet either side of the fence line, is on mildly sloping terrain of grassy nature. Based on the view of the fence line from Mamalahoa Highway, there are little or no trees, although cactus stands may be present.

**Area F** - This 55-acre site follows a rock wall that runs north-south. The rock wall is 3 to 4 feet in height and is constructed of basalt. The site, which is assumed to be 50 feet either side of the rock wall, is on undulating rocky terrain that crosses several gulches. Vegetation consists of tall grass, and small trees and brush that are on the order of 3 to 7 feet in height.



Former Waikoloa  
Manuver Area  
Phase I EE/CA  
Investigation Areas

**Figure 1-2**

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### 1.5.7 PHASE II ENGINEERING EVALUATION/COST ANALYSIS SECTORS

The following is a physical description of the 13 sectors identified for inclusion in Phase II of the EE/CA field investigation (Figure 1-3).

**Sector 1 - Kaniku Lava Flow** includes all the privately owned property in South Kohala District that is south of Waikoloa Road between Queen Kaahumanu and Mamalahoa Highways (Highways 19 and 190, respectively) with the exception of a small piece of land immediately south of Waikoloa Village. This sector covers 12,516 acres.

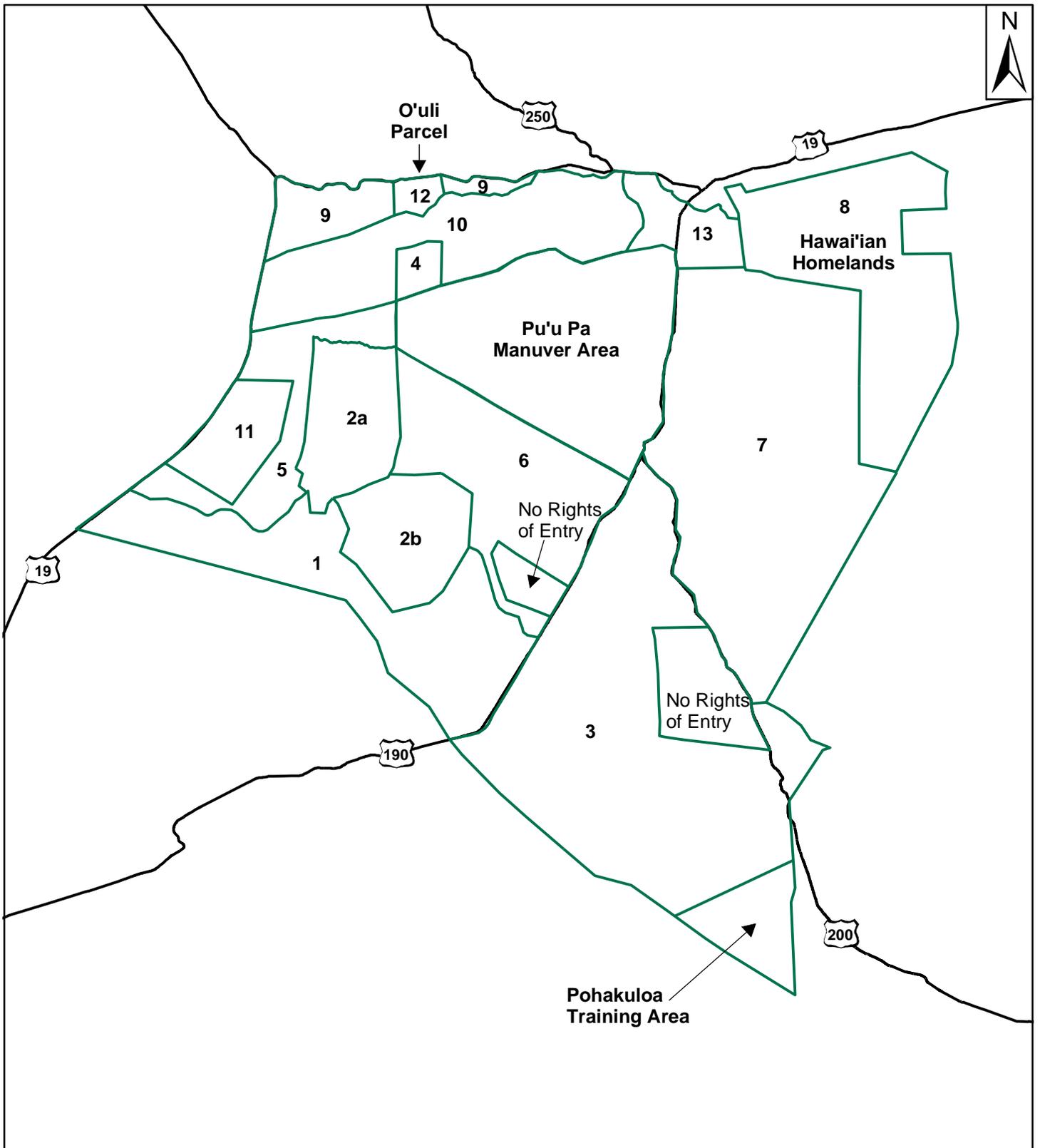
**Sector 2 - Waikoloa Village** comprises the Waikoloa Village proper and the adjoining portion immediately south of the Waikoloa Road. This small piece is included in the Waikoloa Village sector because the area hosts support facilities/buildings and other human habitation associated with the village; OE history is expected to be similar; as would be the concerns of the people occupying the land. Live OE and OE scrap have been found in and around the village, including a live 105mm in the elementary school yard. This area was reportedly used as a live-fire target area for offshore naval gun bombardment. This sector covers 2,498 acres.

**Sector 3 - Keamuku** encompasses the portions of the South Kohala District east of the Mamalahoa Highway and south of the Saddle Road. Approximately 1,467 acres of Keamuku continue to be used for military maneuvers and training exercises through under a master lease agreement between the military organization (e.g., U.S. Army) requesting use of the land and the appropriate landowner. This sector covers 28,058 acres.

**Sector 4 - Lalamilo Wind Farm** is the Lalamilo Ventures Wind Farm and buffer area. Sector 4 is considered separately from Sector 10 because of land use designations. Sector 4 is industrial land, while Sector 10 is residential land. The actual sector boundaries are not known at this time, but the sector is shown as a 6,800-foot by 7,800-foot rectangle centered about the location of the wind farm operations area. Actual sector boundaries will require locating the coordinates of the wind farm borders and will be determined during the field survey. The wind farm is accessible by a well-maintained dirt road. OE scrap found in this location includes high explosive fragments from projectiles that may have been fired from offshore ships. This sector covers 677 acres.

**Sector 5** - is the area south of the Lalamilo state lands and north of the Waikoloa Road between the Queen Kaahumanu Highway and the 1800s vintage rock wall, excluding Waikoloa Village and the Nansay Puako parcel. There are well installation sites near the rock wall, approximately halfway between the Lalamilo Wind Farm and Waikoloa Village. This sector covers 5,963 acres.

**Sector 6 - Puu Pa Maneuver Area** comprises the area north of the Waikoloa Road, between the rock wall and the Mamalahoa Highway south of the Lalamilo state lands and the developed areas of Waimea (as bounded by an existing fence line on the north). The area is accessible by roads and jeep trails. The primary land use is cattle grazing. Historically the area was used for lumbering. Vegetation varies from grass and brush 3 to 7 feet tall on the northwest side of the sector to sparse vegetation with areas of cacti and eucalyptus trees on the northeast side of the sector. Ground cover in the southern portion of the sector consists of 3-foot high grass and loose basalt cobbles and boulders. Topography of the sector varies from flat land to gently rolling hills. Five of the six study areas (A, C-F) from Phase I of this project are included in this sector. This sector covers 24,309 acres.



Former Waikoloa  
Manuver Area

Phase II EE/CA  
Investigation Areas

**Figure 1-3**

**Sector 7 - Holoholoku** is the area east of the Mamalahoa, north of the Saddle Road bounded on the north by the Kamuela Airport area and the Hawaiian Homelands south of Waimea. The area is accessible by roads and jeep trails. This area was used during assault training for the attack on Mount Suribachi. The primary land use is cattle grazing. Historically the area was used for lumbering. Holoholoku puu is included in this sector. Numerous circular depressions are scattered around the base of the puu, covering approximately a 2,778-square foot area. This sector covers 21,601 acres.

**Sector 8 - Hawaiian Homelands** encompasses the Hawaiian Homelands south of Waimea. This sector covers 11,070 acres.

**Sector 9 - Kawaihae Road** is a wedge-shaped sector bounded by the Queen Kaahumanu Highway to the west, the Kawaihae Road to the north and the state-administered Lalamilo lands to the south, excepting the Nansay Ouli parcel. Live OE have been found immediately south of the historic rock wall, the beaches, and Queen Kaahumanu Highway. This sector covers 2,869 acres.

**Sector 10 - Lalamilo State Lands** contains the Lalamilo land administered by the State of Hawaii and extends from the Queen Kaahumanu Highway to the developed area west of Waimea between Sectors 9, 12, and 4-6. Live OE and OE scrap have been found in this sector from the beach areas inland. This sector covers 8,420 acres.

**Sector 11 - Puako Parcel** is located along the eastside of Queen Kaahumanu Highway between Waikoloa Road and Lalamilo state-administered land. There are several cultural sites within this sector, including, but not limited to, a burial area with partial human remains. The area was used as an artillery firing range. Live OE and OE scrap have been found in this sector. Nansay Hawaii, Inc. plans to build golf courses and homes on this parcel. This sector covers 2,629 acres.

**Sector 12 - Ouli Parcel** is the subdivision parcel, owned by Nansay Hawaii, Inc., between Kawaihae Road and Lalamilo lands. There are as many as 75 cultural sites within this sector including, but not limited to, cairns and midden scatters. The area was used as an artillery firing range and as a ground attack training area. Live OE and OE scrap have been found in this sector. Nansay Hawaii, Inc. plans to build golf courses and homes on this parcel. This sector covers 493 acres.

**Sector 13 - West Waimea/Kamuela Airport** encompasses the developed areas of Waimea south of the Kawaihae Road and west of the Hawaiian Homelands. Current land uses in this sector are residential and agricultural. Structural features include the historic Parker Ranch Buildings, the Parker Ranch Headquarters, and the Kamuela Airport. The area of Camp Tarawa is included in this sector. This sector covers 2,298 acres. Area B from Phase I of this project is included in this sector.

#### 1.5.8 PHASE III ENGINEERING EVALUATION/COST ANALYSIS SECTORS

The Phase III EE/CA sectors are uniform areas, or areas with similar characteristics, identified to better characterize OE while minimizing sampling efforts. Sector boundaries were configured to coincide with past, current, or future land use; land ownership or administration; and/or prominent geographic features that would enable field personnel to identify specific sector boundaries in the field. The numeric identifiers and general position are those taken from the SOW. Table 1-1 lists the three Phase III EE/CA sectors along with their respective acreage, location, and OE history.

Table 1-1. Phase III Investigation Areas

No.	Sector Name	Acreage	Location	OE History
15	Hawaiian Homelands Area	11,070	Northeast corner of the former Waikoloa Maneuver Area	No reported discoveries of OE.
16	Area North of Kawaihae Road	3,000	North of Kawaihae Road and Lalamilo state land, extending from Queen Kaahumanu Highway to Waimea	No reported discoveries of OE. However, live OE found south of Kawaihae Road and within Lalamilo State Lands
17	Area West of Queen Kaahumanu Highway	2,500	West of the former Waikoloa Maneuver Area to the beaches, across the Queen Kaahumanu Highway, extending north from Waikoloa Road to Kawaihae Road.	Portion of the sector previously used for World War II Amphibious Training. Live OE and OE scrap have been reported in the beach areas inland to the former Lalamilo Firing Range.

**Sector 15 - Hawaiian Homelands Area** encompasses the Hawaiian Homelands south of Waimea. This sector covers 11,070 acres and is accessible primarily by county dirt road. Two small eastern portions of the sector were within the original Waikoloa Maneuver Area boundary. No live OE has been reported in the sector. The sector is characterized by vast grazing pastures.

**Sector 16 – Area North of Kawaihae Road** is a rectangular-shaped sector bounded by the Queen Kaahumanu Highway to the west, the Kawaihae Road to the south and the Kohala Mountain to the north. This sector covers 2,869 acres and has limited accessibility since a barbed wire fence runs almost the entire length of the sector, with the exception of a tank trail in the east portion of the sector. No live OE has been reported in this sector. However, live OE have been found immediately south of the Kawaihae Road, near the historic rock walls and within the Lalamilo State Lands. The sector is characterized by vast grazing areas along the foothills of the Kohala Mountains and inclines from 10 to 45 degrees, with gullies throughout the sector.

**Sector 17 – Area West of Queen Kaahumanu Highway** is located along the western side of Queen Kaahumanu Highway, north of Waikoloa Road and south of Kawaihae Road. This sector covers 2,629 acres and is highly accessible by developed road. There are several cultural sites within this sector, including, but not limited to, a burial area with partial human remains. Portions of the area were used as an artillery firing range. Live OE and OE scrap have been found in this sector. Nearly the entire coastline is developed and contains several beach resorts and residential housing developments.

## 1.6 SITE HISTORY

In December 1943, approximately 91,000 acres were acquired by the U.S. Navy through a licensing agreement with Richard Smart of the Parker Ranch. Portions of the 91,000 acres were used as an artillery firing range, while other portions were used for troop maneuvers. Approximately 467 acres of the property (near the town of Kamuela) was used for tents and Quonset huts as Camp Tarawa.

The entire Waikoloa Maneuver Area was in constant use, as the Marine infantry reviewed every phase of training from that of individual fighting to combat team exercises. Intensive live-fire training was conducted in forested areas, cane fields, and around the cinder hills, in particular Puu Pa and Holoholoku. Holoholoku was known as "Red Hill" to the soldiers and was used as the training area for the planned assault on Mount Suribachi. Exercises were conducted with carbines, miscellaneous-caliber rifles (including the Browning automatic rifle), bazookas, flame-throwers, mortars, and machine guns. Artillerymen learned how to load and unload howitzers from large amphibian trucks, and practiced with hand grenades; 37mm, 75mm, 105mm, and 155mm high explosive shells; 4.2-inch mortar rounds; and test-fired packages of Japanese-language surrender leaflets. Infantry regiments conducted continuous 72-hour maneuvers with fighter and dive-bomber support, and air observation was practiced from OY Cub-type planes. There were constant training schedules with demolitions, mines, and other special equipment. Large numbers of heavy equipment were brought to the island for the training and included construction equipment (e.g., cranes, bulldozers, tractors), M4A2 and M4A4 tanks, weapons carriers, trucks, and jeeps. For more detailed information and references, refer to Appendix A of the *Master Work Plan*.

## 1.7 CURRENT AND PROJECTED LAND USE

The project team will determine the current and future land use of the Phase III EE/CA sectors during the Technical Project Planning (TPP) for the Phase III EE/CA. The Phase I TPP meeting is scheduled for 29 October 2003.

## 1.8 PREVIOUS INVESTIGATIONS

### 1.8.1 PREVIOUS REMOVAL ACTIONS

Several sweeps of the former Waikoloa Maneuver Area have been conducted. The first occurred in 1946 by the 1522nd MIDPAC Engineers Operations Search Dud Team. The sweep took place over 2-1/2 months, and was focused on impact areas used for artillery and bombing practice. A large detail of personnel crisscrossed the range at arm's length distance searching for OE. At completion, the officer-in-charge declared that the area had been thoroughly policed for dud shells. However, he added that certain areas were impossible to search (i.e., around large cactus) and that OE could still be present.

In 1954, following the death of two Parker Ranch employees, a team of 50 men from ordnance disposal units from Fort Shafter and Hickam Air Force Base searched 110,000 acres, and identified and disposed of thousands of munitions.

### 1.8.2 DECEMBER 1991 VISUAL SURVEY

In December 1991, a helicopter survey and subsequent drive and walk-through survey was conducted by the USACE Honolulu District (Earth Tech, 1997). The survey was conducted throughout the 91,000 original acres of the former maneuver area. Large amounts of artillery fragments and several different types of fuzes were located. In November 1992, several walk-through visual and OE locator surveys were conducted by Donaldson Enterprises, Incorporated (DEI) under contract to the USACE Honolulu District. The surveys were conducted within the former Lalamilo Firing Range. OE-related items identified within this area were primarily found on the surface and included the following:

- Shrapnel (artillery projectile fragments)
- Fuze components

- 
- Burned-out rounds
  - Low-order rounds (i.e., not all explosives expended)
  - 4.5-inch barrage rockets
  - 81mm mortars
  - 105mm and 155mm High Explosives (HE) fragments
  - 30-caliber and 50-caliber small arms
  - Hand grenades
  - Munitions containing white phosphorus.

#### 1.8.3 APRIL 1996 SITE VISIT

In April 1996, a site visit to the former maneuver area was conducted by the USAESCH and the USACE Honolulu District. The purpose of the survey was to inspect six parcels situated within the Parker Ranch property that were currently proposed for development. The following items were seen during the site visit:

- Mortar fragments
- Tail section from a 60mm mortar
- Fragments from a MKII hand grenade
- Land mine fuzes
- 7.62-caliber ammunition (live and expended)
- 30-caliber small arms ammunition
- Hand grenade fuze
- Propellant charge cans
- 75mm HE fragments
- 60mm illumination rounds
- 105mm HE fragments
- 81mm HE fragments
- 76mm fuze
- 60mm nose fuze.

#### 1.8.4 PHASE I ENVIRONMENTAL ASSESSMENT

In August 1996, Earth Tech conducted a Phase I site survey for a 3,000-acre area situated within the southwest portion of the former maneuver area near the Puako parcel. The Phase I Environmental Assessment was conducted in support of the development of a golf course community. OE scrap was identified throughout the parcel; however, the highest densities of OE scrap were located approximately 1 mile inland near the confluence of Awaiakeakua Gulch and an unnamed gulch and in the northwest corner of the parcel along the Queen Kaahumanu Highway. No intact ordnance was found during this survey; however, heavily vegetated areas were not thoroughly searched.

### 1.8.5 PHASE I ENGINEERING EVALUATION/COST ANALYSIS

In September 1997, the Phase I EE/CA field investigation was conducted by Earth Tech under contract to the USAESCH (Project No. H09HI035901). Between September and October 1997, a total of 96 sampling grids (91 100-foot by 100-foot grids and 5 10-foot by 400-foot grids) distributed over 6 investigation areas (Areas A-F) were geophysically surveyed and statistically sampled. The Phase I EE/CA was performed in an area not addressed or included as part of the Phase II EE/CA investigation. The Phase I EE/CA was performed primarily in the Puu Pa Maneuver Area, where active military training maneuvers are still being conducted by the U.S. military. The investigation of the Phase I EE/CA project area yielded 2 UXO items (4.5-inch barrage rocket in Area D - Puu Pa Cinder Hill; 60mm mortar in Area C - Wastewater Treatment Area) and 96 OE scrap items (inert and non-hazardous). Both UXO items were rendered safe by explosive demolition.

The recommendations that were made as a result of the Phase I EE/CA field investigation are presented in the *Phase I Engineering Evaluation/Cost Analysis, Former Waikoloa Maneuver Area - Parker Ranch, Kamuela, Island of Hawaii, Hawaii* (Earth Tech, 1999). These recommendations included institutional controls (i.e., OE safety awareness training program, community awareness, educational media) and construction support.

### 1.8.6 PHASE II ENGINEERING EVALUATION/COST ANALYSIS

In May 2001, the Phase II EE/CA field investigation was completed by Earth Tech under contract to the USAESCH (Project No. H09HI035902). During the Phase II EE/CA field investigation, the field investigation team recovered 38 UXO items, 2,160 OE scrap items, and 1,343 small arms rounds (approximately 370 pounds) distributed over 13 sectors using visual survey, geophysical survey and statistically sampling. During the Phase II EE/CA investigation, USAESCH and USACE Honolulu District coordinated the Time Critical Removal Action (TCRA) at the Ouli Parcel to address human safety concerns based on investigation finding. OE recovered during the TCRA was tallied into the totals for the Phase II EE/CA. UXO was recovered in Sectors 2a, 4, 5, 6, 9, 10, 11, 12, and 13, while OE scrap was recovered in all of the sectors investigated.

The recommendations that were made as a result of the Phase II EE/CA field investigation are presented in the *Phase II Engineering Evaluation/Cost Analysis, Former Waikoloa Maneuver Area and Nansay Sites, Island of Hawaii, Hawaii* (Earth Tech, 2002). These recommendations included institutional controls (i.e., OE safety awareness training program, community awareness, educational media) and construction support.

## 1.9 INITIAL SUMMARY OF EXPLOSIVE ORDNANCE RISK

Significant OE data is not available to thoroughly characterize the OE risks with the three Phase III EE/CA sectors. However, based on historic accounts and previous OE investigations and removal action with the former Waikoloa Maneuver Area, it is possible the project team may encounter the following types of OE during the Phase III EE/CA data collection efforts:

- Fuze and booster from an 81mm mortar
- 60mm mortar shell
- 2.75-caliber rocket

- Japanese 25mm anti-aircraft/anti-tank round
- 47mm anti-tank Japanese armor-piercing projectile fuze
- 37mm anti-tank cannon
- 81mm mortar shell
- Rifle and hand grenades
- 60mm illumination rounds
- 4.2-inch mortar shell
- 75mm HE shells
- 105mm HE shells
- 155mm HE shells
- Land mines
- 22-caliber to 50-caliber small arms
- 2.36-inch rockets
- 3.5-inch rockets
- 4.5-inch barrage rockets.



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## 2. TECHNICAL MANAGEMENT PLAN

### 2.1 PROJECT OBJECTIVES

The overall objective of the EE/CA process is to identify and recommend a feasible and cost effective response alternative for remnant OE related problems affecting human use of the site; determine and recommend areas that should receive response actions using the risk reduction option selected by the Government; perform risk evaluation of the site based on the potential response action options; and provide a convenient record of the process for use in final decision making within the former Waikoloa Maneuver Area that is protective of human health with respect to the intended future land use at the site.

USA has prepared preliminary project objectives for the Phase III EE/CA in accordance with USACE Interim Guidance for TPP. The TPP team will continue to develop and refine project objectives to guide the development and focus the comparison of acceptable response action alternatives for Phase III EE/CA sectors. USA has documented these preliminary project objectives in the TPP Project Objectives Worksheet (Appendix I). Preliminary project objectives include:

- Define current and future land use;
- Delineate OE within Sectors 15, 16, and 17
- Impact Analysis/Ordnance and Explosive Risk Impact Assessment (OERIA); and
- No DoD Action Indicated (NDAI)/Remedial Action decision

The above objectives for the OE EE/CA of the former Waikoloa Maneuver Area will be accomplished by:

- involving the local communities and stakeholders in the TPP for the Phase III EE/CA of the former Waikoloa Maneuver Area;
- conducting a Geophysical Prove-Out to test and select an appropriate digital geophysical system for geophysical mapping surveys;
- conducting a historical analysis and data review to collect data necessary for qualitative analysis of OE risk at the project site;
- performing instrument-assisted ground reconnaissance of the project sectors, geophysical investigations based on ground reconnaissance results, and intrusive investigation of detected anomalies to characterize the OE risk within the project site;
- performing qualitative OE risk evaluation and response alternative evaluation (OERIA) to determine the most appropriate response alternative for each Phase III EE/CA sector;
- providing the public and local agencies the opportunity to review and comment on the Draft Final EE/CA Report; and
- performing an Institutional Analysis to identify and analyze the institutional framework necessary to support the development of institutional controls as an effective OE response action alternative for the Phase III EE/CA sectors.

### 2.2 PROJECT ORGANIZATION

For the EE/CA process to be successful, close coordination and cooperation between the stakeholders, community, regulators, and technical support personnel must occur. Several organizations are directly involved in this Phase II EE/CA of the former Waikoloa Maneuver Area. Figure 2-1 depicts the organization structure for this Phase III EE/CA project. The TPP

team consisted of the USACE Honolulu District, USAESCH, USA, and the former Waikoloa Maneuver Area stakeholders. The roles of these team members are described below.

2.2.1 U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT

USACE Honolulu District is the project management and funding agency for this project. USACE Honolulu District responsibilities include review of project plans and documents, supporting USA in obtaining rights-of-entry for properties in the investigation areas, working with the news media and the public, and coordinating with state and local regulatory agencies on issues pertaining to protection of ecological and cultural resources.

2.2.2 U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE

USAESCH is the lead technical agency for this project. USAESCH responsibilities include procurement of architect/engineer services, direction of the EE/CA contractor, review and coordination of project plans and documents, and working with the news media and the public. USAESCH provided technical expertise for OE activities. As the technical Project Manager, USAESCH is responsible for directing the EE/CA contractor and controlling the budget and schedule.

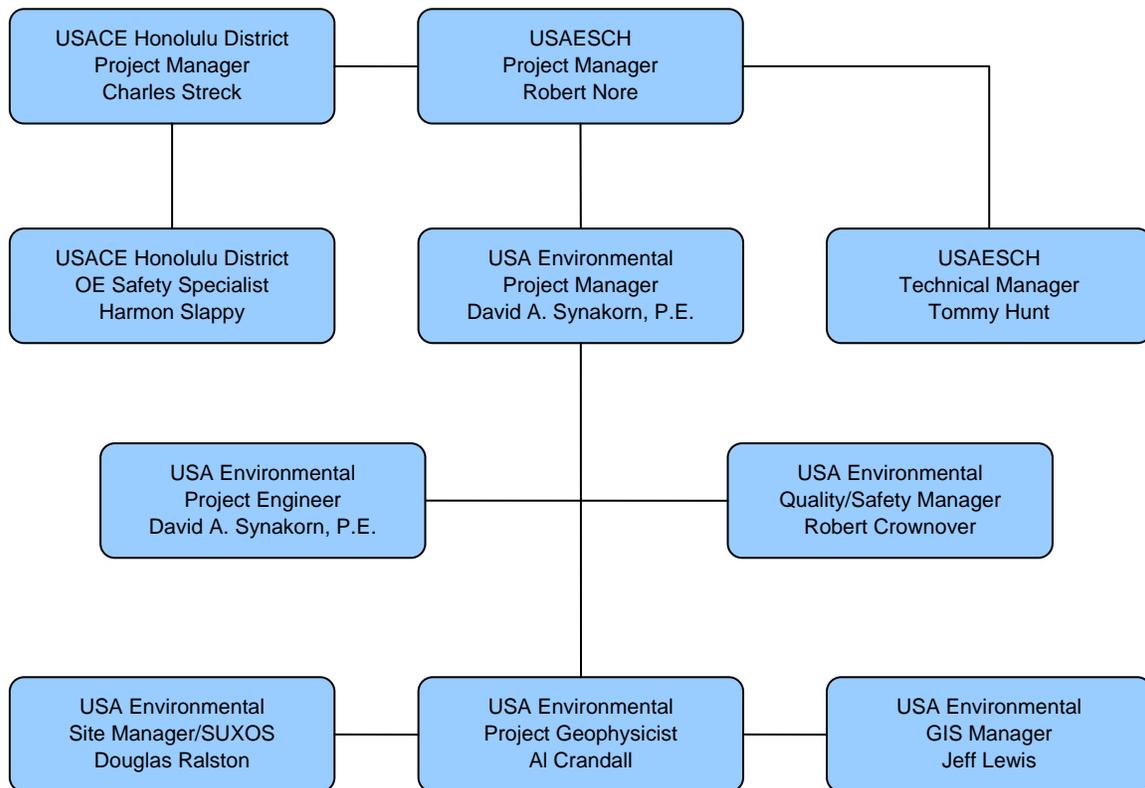


Figure 2-1. Waikoloa Maneuver Area Phase III EE/CA Project Organization

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### 2.2.3 FORMER WAIKOLOA MANEUVER AREA STAKEHOLDERS

The former Waikoloa Maneuver Area stakeholders are the individuals and organizations directly impacted by the Phase III EE/CA activities and the final OE response actions selected for the Phase III EE/CA sectors. Stakeholders include (but are not limited to):

- Waikoloa Restoration Advisory Board (RAB)
- Communities of Puako, Waikoloa Village, Waimea, and South Kohala
- Hawaii Department of Land and Natural Resources
- Department of Hawaiian Homelands
- State of Hawaii

### 2.2.4 USA ENVIRONMENTAL, INCORPORATED

USA is the prime contractor to USAESCH. USA provides comprehensive engineering, project management, and quality control (QC) support services for the Phase III EE/CA of the former Waikoloa Maneuver Area. USA is responsible for managing the schedule and budget to ensure completion of the EE/CA tasks detailed in the SOW. USA properly trained and qualified UXO personnel and geophysical professionals will conduct escort and visual OE removal of access routes and areas designated for geophysical investigation, perform the necessary geophysical survey activities, evaluated the geophysical data, and perform necessary intrusive investigation of detected anomalies to characterize the OE risk at the project site. The USA GIS Manager will incorporate collected real estate and geophysical investigation data into the existing GIS database. USA will provide the Senior UXO Supervisor (SUXOS), the UXO Quality Control Specialist (UXOQCS), and the UXO Safety Officer (UXOSO) for the EE/CA activities. USA will also conduct an OE risk impact analysis as part of the EE/CA work. The USAESCH Contracting Officer will direct all work performed by USA and its subcontractors. Resumes of key USA management and field personnel are presented in Appendix H.

## 2.3 PROJECT PERSONNEL

### 2.3.1 USA PROJECT MANAGER

The Project Manager is responsible for monitoring the overall progress of the Task Order, reviewing monthly progress reports, and ensuring that resources were available to the Task Order Manager. The Project Manager maintains close communication with USAESCH to assess client satisfaction with USA performance on this Task Order.

### 2.3.2 USA QUALITY MANAGER

The Quality Manager is responsible for reviewing and updating the Quality Plan and verifying compliance with the plan. Compliance is verified through audits of project activities by the Quality Manager, who has the authority to require corrective actions to ensure compliance with the Quality Plan.

### 2.3.3 USA SAFETY MANAGER

The Safety Manager develops and coordinates the Site Safety and Health Plan (SSHP). The Safety Manager is the contact for regulatory agencies on matters of

health and safety. For this project, the Quality Manager also serves as the Safety Manager.

#### 2.3.4 USA ENVIRONMENTAL ENGINEER

The Environmental Engineer provides technical, analytical, and report writing support to the EE/CA to ensure the technical quality of deliverables to USAESCH.

#### 2.3.5 USA GEOGRAPHICAL INFORMATION SYSTEMS MANAGER

The Geographic Information Systems (GIS) Manager is responsible for management and control of the project GIS. The GIS Manager will direct GIS operations occurring locally and remotely, and is responsible for control of data included in and used as part of the project GIS.

#### 2.3.6 PROJECT GEOPHYSICIST

The Project Geophysicist provides oversight and direction for all geophysical activities in support of the EE/CA. The Project Geophysicist is responsible for the quality and interpretation of the geophysical data collected.

#### 2.3.7 GEOPHYSICAL SUBCONTRACTOR

The geophysical subcontractor provides backup support for the geophysical investigations and performs the following tasks:

- Collects geophysical data, identifies anomalies, and marks locations of anomalies to be investigated
- Provides consultation relative to the conduct of the field investigation and resolves questions/problems relating to the proper function of the geophysical instrumentation used
- Performs field data QC, including oversight of data downloading, field survey documentation, and data tracking.

## 2.4 PROJECT COMMUNICATION AND REPORTING

### 2.4.1 COMMUNICATIONS

#### 2.4.1.1 Project Communications

Communications for this project will generally flow along the lines established by the organization depicted previously in Figure 2-1. All communications between USA and the USAESCH will primarily be directed through the respective Project Manager or the Contracting Officer at USAESCH. Communication directly between USA and other government entities associated with this project will only occur when directed by USAESCH.

#### 2.4.1.2 Project Correspondence

All primary correspondence will be sequentially numbered. Monthly reports of progress will be prepared and provided to the USAESCH Project Manager, with copies of the cover letter provided to the Contracting Officer.

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#### 2.4.1.3 Project Internet Web Page

USA will utilize a dedicated Internet Web page to disseminate information to the project team and the public. This Web page will be updated periodically with new information about the project and will be used to post copies of monthly reports, documents, and other correspondence as desired by USAESCH. Some of the access will be password protected as determined necessary by USAESCH. The USA project Website address is <http://www.usaprojecthost.com>.

### 2.4.2 RECORDS MANAGEMENT

#### 2.4.2.1 Project Records

Hard copies of primary records for the former Waikoloa Maneuver Area Phase III EE/CA will be retained in the project files at the USA Corporate Office in Tampa, Florida. Such records will include the Delivery Order and any modifications, correspondence including minutes of meetings and monthly reports, draft submittals, responses to comments and final submittals, and correspondence received from USAESCH or other agencies. Electronic versions of working products will be retained within the USA Tampa network server. Access to all servers is password controlled. Historic records and documents, previous study reports, and related items will be retained in working files located in the USA Project Manager office. Master GIS information will be retained on the Tampa GIS Server during the course of the project. Access is limited by password to only those individuals manipulating the data. USA will provide copies of this data to USAESCH on CD-ROM and on a secure Website as required by the SOW.

#### 2.4.2.2 Field Records

During field efforts, records will be maintained in the project field office with copies delivered weekly to the project files in Tampa, Florida. Following completion of the fieldwork, all files will be delivered to the project files in Tampa, Florida. Such records will include geophysical logs, geophysical data, daily summary sheets, and related field and daily logs.

#### 2.4.2.3 Format and Content of Engineering Reports

Engineering reports presenting all data, analyses, and recommendations will be prepared and submitted in accordance with the SOW. The contents and format of the engineering reports will be arranged in accordance with all pertinent guidance documents, specifically the applicable Data Item Descriptions (DID).

### 2.4.3 MONTHLY PROGRESS REPORT

USA will prepare and submit a monthly progress report describing the work performed since the previous report, work currently underway and work anticipated (DID OE-080.01). The report will state whether current work is on schedule. If the work is not on schedule, USA will state what actions are anticipated in order to get back on schedule. Tracking of the costs associated with all Firm Fixed Price (FFP) tasks will be performed by percentage completed listed on the report. All time and material tasks will be tracked by the amount of work to be completed based on the SOW. The report will be sent by regular mail by the 10<sup>th</sup> day of the following month.

## 2.5 PROJECT DELIVERABLES

This section provides a brief description of the required deliverables for the Phase III EE/CA of the former Waikoloa Maneuver Area. A detailed description of project deliverables is provided in the SOW (Appendix A). USA will submit all deliverable data to the USACE Honolulu District and USAESCH no later than the close of the business day indicated in the project schedule. USA will submit electronic data in formats consistent with USAESCH software and systems, as defined in the SOW.

### 2.5.1 ENGINEERING EVALUATION/COST ANALYSIS WORK PLAN

USA will prepare and submit a draft and final Phase III EE/CA Work Plan for the former Waikoloa Maneuver Area as outlined in DID OE-001.01. USA will perform an overall review of each document prior to submittal to confirm the general quality of the product. USA will incorporate reviewer comments and issue a formal, annotated response to each comment.

### 2.5.2 ENGINEERING EVALUATION/COST ANALYSIS REPORTS.

USA will prepare and submit a draft and final Phase III EE/CA Report for the former Waikoloa Maneuver Area as outlined in DID OE-010.01. USA will perform an overall review of each document prior to submittal to confirm the general quality of the product. USA will incorporate reviewer comments and issue a formal, annotated response to each comment.

### 2.5.3 PROJECT CONTROL AND REPORTING

USA will prepare and submit a Work, Data, and Cost Management Plan in accordance with DID OE-005-08.01.

### 2.5.4 PROJECT STATUS REPORT

USA will prepare and submit a project status report in accordance with DID OE-085.01. USA will include a deficiency report in the weekly report, which list all deficiencies and required corrective actions in a Corrective Action Report (CAR). Deficiencies will include surveying, geophysical mapping, geophysical analysis, reacquisition, and QC and quality assurance (QA) failures.

### 2.5.5 MINUTES OF MEETINGS

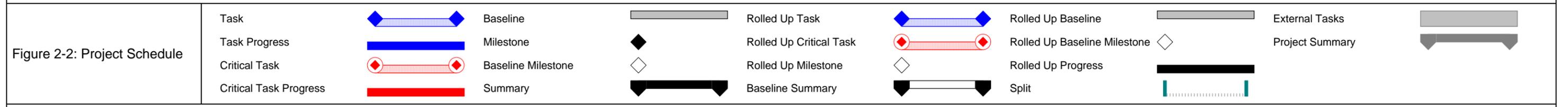
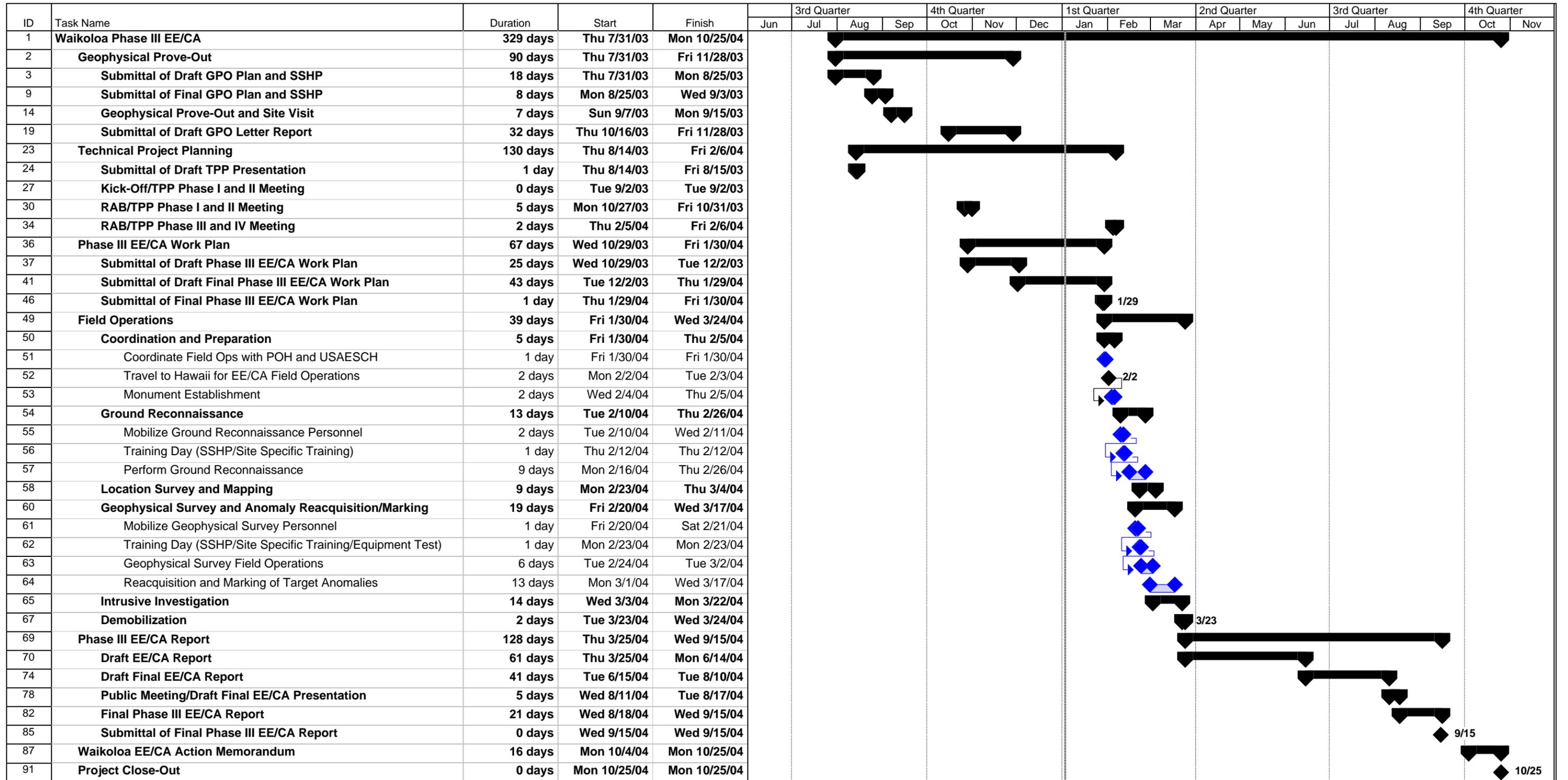
USA will prepare and submit minutes of all meetings attended to the USAESCH Project Manager within 10 calendar days.

### 2.5.6 CORRESPONDENCE

USA will maintain a record of phone conversations and written correspondence affecting decisions relating to the performance of this Task Order. USA will submit a summary of the phone conversations, e-mails, and written correspondence with the monthly Project Status Report.

## 2.6 PROJECT SCHEDULE

The project schedule will be initiated with the Notice to Proceed (NTP) and ends with the completion of the Final EE/CA Action Memorandum, projected for April 2005. Figure 2-2 depicts the anticipated schedule for this project.





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## 2.7 PERIODIC REPORTING

USA will conduct periodic status meetings to provide status updates to all vested parties. USA will coordinate and schedule these meetings based on client/management needs. In addition, USA will prepare and distribute monthly progress reports and weekly field reports from the USA corporate office in Tampa, Florida.

## 2.8 COST AND BILLING

The budget for the project was negotiated with the USAESCH pursuant to contract number DACA87-00-D-0036. USA will submit a monthly invoice to the USAESCH. The USA Project Manager is responsible for submitting monthly reports to the USAESCH Project Manager along with the invoice that documents the work performed during the corresponding billing period.

## 2.9 PROJECT PUBLIC RELATIONS SUPPORT

USA will support community relations efforts during the project life. The support shall include preparation and delivery of briefings, graphics and presentations, participation in site visits and the TPP process, and development of information or educational packets to inform the public. The objectives of these community relations efforts include:

- Ensuring that information is provided to the public, residents, and employees; and Federal, state, and local agencies in a timely manner
- Identifying those individuals and organizations involved in the review and comment process for studies conducted
- Effectively interacting with the media by timely responses to inquiries and interviews and in the prompt distribution of press releases
- Creating and maintaining a climate of understanding and trust between USAESCH, USACE Honolulu District, and the local community, including the news media, by providing information and the opportunities for comments and discussions.

USA will attend and participate in 3 public meetings, to be held in the vicinity of the project site. These meeting dates have not been set; however, the first meeting is anticipated to be held on 29 October 2003. One additional independent meeting will be held at USAESCH at which the USA will present findings of the characterization effort/field work along with plans for developing the EE/CA report. This meeting will occur prior to demobilization from the project site and prior to submittal of the Draft EE/CA Report.

USA will coordinate community relations efforts and the release of all information, reports, and/or data under this contract with USACE Honolulu District and USAESCH. Additionally, requests for project-related information will be deferred to the USACE Honolulu District Public Affairs Officer (PAO). Contact information is provided below.

Mr. Larry Hawthorne, PAO  
Commander  
U.S. Army Corps of Engineers, Honolulu District  
Fort Shafter, Hawaii  
(808) 438-9862

## 2.10 SUBCONTRACTOR MANAGEMENT

Before subcontract work is performed, USA will negotiate and prepare a subcontract that will detail all necessary and appropriate terms and conditions, including the SOW. Once the subcontract is executed, USA will perform periodic reviews to ensure that contractual requirements and milestones are met. These reviews will cover contractual progress, technical progress, and cost and schedule status.

In addition to reviews, USA will require subcontractors to prepare monthly technical progress reports that identify one or more of the following: (1) progress and status of work; (2) significant accomplishments during the reporting period; (3) comparison of actual, technical, and schedule progress versus planned progress; (4) status of all long lead/critical delivery items; (5) analysis of significant problems; (6) current expenditures and status of work in terms of labor and dollars spent versus budget; and (7) a summary of specific plans for the next reporting period.

USA subcontract control responsibilities including:

- Preparation and maintenance of a subcontract file, including all information generated during negotiations
- Work authorization records and maintenance
- Coordination of all documents required for internal administration
- Subcontractor coordination including the receipt and transmission of all correspondence
- Review of subcontractor invoices prior to payment
- Modification of subcontracts as required to reflect changes in technical direction during the term of the subcontract
- Monitoring subcontractor work to assess progress.

USA technical staff will review data generated by the subcontractor as part of subcontract deliverables. In the field, the USA Site Manager will review and sign subcontractor daily log/report detailing labor and equipment utilized. The USA Site Manager will take great care in determining quantities so as to eliminate discrepancies that may arise on subcontractor invoices.

## 2.11 FIELD OPERATIONS MANAGEMENT

During collection of geophysical data and OE sampling, the USA Site Manager/SUXOS will manage field operations from outside the exclusion zone at a command post established in the vicinity of the project site. For public safety, USA personnel will prevent access of unauthorized personnel to work areas.

The USA Safety Manager will remain off site but will be available by telephone for consultation on safety issues. The USA UXOSO will be on site during field activities to ensure all activities comply with SSHP.

The USA GIS Manager, who is responsible for control of data included in and used as part of the project GIS, will also be available by telephone for consultation.

Upon completion of field activities, USA will prepare the Phase III EE/CA Report and EE/CA Action Memorandum. USA will submit field records to the USAESCH at project completion. USA will submit survey records to the USAESCH 30 days after completion of fieldwork.

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### 3. FIELD INVESTIGATION PLAN

This chapter details the approach and procedures for the Phase III EE/CA field investigations required to collect data of sufficient quantity and quality to properly assess the OE risk associated with the project sites. USA will perform all field activities in accordance with the SSHP and in compliance with USACE, Federal, State, and local requirements.

#### 3.1 TECHNICAL APPROACH

##### 3.1.1 SITE CHARACTERIZATION GOALS

Identifying TPP Team goals is critical within the TPP process to ensure appropriate planning activities. Goals are defined by current and future land use, regulatory compliance, and budget and schedule requirements and limitations.

USA has developed preliminary project goals for the Phase III EE/CA in accordance with USACE Interim Guidance for TPP. The TPP team will continue to develop and refine project goals to guide the site characterization efforts. USA has documented these preliminary project goals in the TPP Memorandum for Record (MFR) Worksheet (Appendix I). The sole preliminary project goal is to determine if the land within the project site is safe for continued use by property owners. Based on this preliminary project goal, site characterization goals may include:

- Document available information pertaining to the nature and extent of OE at the former Waikoloa Maneuver Area
- Identify areas where further investigation is warranted
- Conduct a field investigation of the project site to characterize the nature and extent of OE within the project sectors
- Perform qualitative assessment of OE risk at the project site.

##### 3.1.2 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative statements derived from the TPP process that clarify study objectives, define the appropriate type of data, and specify the tolerable levels of potential decision errors that are used as the basis for establishing the quality and quantity of data needed to support decisions. These project specific statements describe the intended data use; the data need requirements; and the means to achieve acceptable data quality for the intended use. DQOs produced through the TPP process meet the U.S. Environmental Protection Agency (USEPA) definition of a DQO.

USA has prepared preliminary DQOs in accordance with USACE Interim Guidance for TPP. The TPP team will refine the DQOs during the final step of the TPP process to finalize and document the data collection options and decisions. Table 3-1 lists the preliminary DQOs documented in the TPP DQOs Worksheet in Appendix I.

Table 3-1. Preliminary Data Quality Objectives

<b>Data Quality Objective 1:</b>	
Intended data use:	To define current and future land use (TPP Objective 1) To perform impact analysis/OERIA (TPP Objective 3)
Data need requirement:	Current and future land access, development, and use
Data category:	Basic
Quantity of data:	Sufficient data to characterize current and projected human activity in the areas of concern
Data collection method:	Coordination of TPP for the OE EE/CA of the former Waikoloa Maneuver Area
<b>Data Quality Objective 2:</b>	
Intended data use:	To delineate OE within project site (TPP Objective 2)
Data need requirement:	OE potential within areas of concern
Data category:	Basic
Quantity of data:	Any presence of OE on the surface or subsurface of the areas of concern
Data collection method:	site visits, TPP, interviews, historical analysis, instrument-assisted ground reconnaissance, geophysical mapping of grids based on reconnaissance, intrusive investigation (as needed, based on geophysical mapping)
<b>Data Quality Objective 3:</b>	
Intended data use:	To perform impact analysis/OERIA (TPP Objective 3)
Data need requirement:	OE potential within areas of concern
Data category:	Basic
Quantity of data:	Any presence of OE on the surface or subsurface of the areas of concern
Data collection method:	site visits, TPP, interviews, historical analysis, instrument-assisted ground reconnaissance, geophysical mapping of grids based on reconnaissance, intrusive investigation (as needed, based on geophysical mapping)
<b>Data Quality Objective 4:</b>	
Intended data use:	NDAI/RA decision (TPP Objective 4)
Data need requirement:	OE risk within areas of concern
Data category:	Basic
Quantity of data:	Any presence of OE on the surface or subsurface of the areas of concern, or data to support decision of No DoD Action Indicated or appropriate Removal Actions
Data collection method:	OERIA

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### 3.1.3 DATA INCORPORATION

#### 3.1.3.1 Data Reporting

USA will incorporate collected field data and GIS data in the EE/CA Report in accordance with in DID OE 005-05.01. For all anomaly analyses and review, at a minimum, the GIS data packages/maps will show traceability to the anomaly location and will contain the following information required for data validation:

Case narrative describing any deviations form the normal anomaly evaluation procedures required and the anomalies affected:

- Anomaly location identifications;
- Geophysical data set identifications;
- Individual parameter results; and
- Summary of all GIS QC procedures.

As a part of the data evaluation process, the GIS Manager will confirm that the documentation is complete, paginated, and legible; qualitative identification is accurate; calculations are accurate; and the results are expressed in the appropriate units. A copy of the OE/UXO data as displayed on the GIS anomaly maps will be checked for completeness and compliance. In addition, the data will be validated and any results not in compliance with established QC criteria will be identified. The effect of any noncompliance on the usability of the data will be addressed with USAESCH.

#### 3.1.3.2 Final Reports and Maps

USA will generate all final maps using ESRI Arc View and submit digital design files to the USAESCH on a PC CD-ROM. All characteristics (such as file naming and relationships, level structures, colors, line styles, weights, etc.) will be compiled on reproducible drawings in accordance with the surveying and mapping requirements of the Tri-Service Spatial Data Standards. The size of these drawings will be based on the information that is to be displayed.

The location, identification, and coordinates of all the control points will be plotted on the reproducible maps (the surveyors control points will be provided to USAESCH in digital format). Each map will include grid north. Grid lines or tick marks in feet and at systematic intervals will be shown with their grid values on the edges of the map. A legend showing symbols used for the mapping, a map index showing the site in relationship to all other sites within the boundary lines of the project area, a border, and a standard USACE title block will be shown on each map.

### 3.1.4 EXPOSURE ANALYSIS

Once the nature and extent of OE contamination are characterized, USA will assess the potential risk due to exposures to OE contamination. USA will characterize the potential OE risk at the project site by evaluating the ordnance, site characteristics, and human exposure pathways. The ordnance category includes the type of OE identified, the level of sensitivity (i.e., the potential adverse health effects associated

with exposure to the specified OE), the density of UXO in a specified area, and the depth of the UXO.

### 3.1.5 ALTERNATIVES IDENTIFICATION AND ANALYSIS

Due technical and financial limitations, complete removal of all OE is not feasible. Conversely, permanent exclusion of the public from areas that have the potential to contain OE is also not feasible, given private land ownership, future demands for use of the land, and the potential for inadvertent and intentional entry. The purpose of an EE/CA is to evaluate potential ordnance risk and develop alternative plans of action.

Figure 3-1 depicts the chain of events leading to an OE incident, causing injury or death.

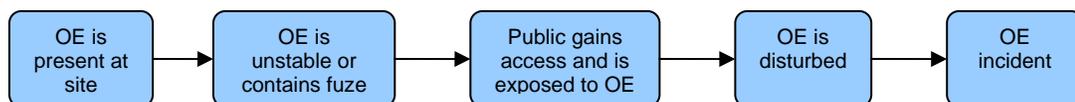


Figure 3-1. OE Incident Chain of Events

#### 3.1.5.1 Alternatives Identification

Although development, evaluation, and incorporation of OE response alternatives may be conducted throughout the EE/CA process, USA will use four widely excepted OE response alternatives as the starting point for alternatives identification and analysis. These four alternatives include:

- No DoD Action Indicated (NDAI)
- Institutional Controls
- Surface Removal of OE
- Subsurface Removal of OE to Depth of Detection

##### 3.1.5.1.1 No Department of Defense Action Indicated

NDAI involve no active response or land use restrictions (i.e., institutional controls) to locate, remove, dispose of, or limit the exposure to any potential OE present within a specific AOC at the project site. In addition, DoD would assume no responsibility for public awareness or education concerning the potential OE risk within a specific AOC at the project site. The No Action approach is routinely retained in the EE/CA evaluation of alternatives in accordance with the requirements of the NCP to provide a baseline for comparison of other response technologies and alternatives.

##### 3.1.5.1.2 Institutional Control

Institutional Controls involve implementation of physical and administrative measure to limit the access or use of a specific AOC at the project site. Instead of direct removal of the OE from a specific AOC, the Institutional Controls response action relies

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on behavior modification and access control strategies to reduce or eliminate OE risk.

Institutional controls may include engineering controls, educational programs, legal mechanisms, and construction support. The overall effectiveness of institutional controls depends entirely on local agencies and private landowner support, involvement, and willingness to enforce and maintain institutional controls implemented to minimize public interaction with OE.

#### 3.1.5.1.3 Surface Removal

The surface removal of OE alternative may be a viable OE response alternative if the OERIA indicates that there is a high number of anticipated exposures to OE by the public on the ground surface and a low risk of exposure to subsurface OE.

Surface OE removal would be completed by experienced OE qualified personnel who visually search the ground surface for any OE. In addition, OE qualified personnel would use metal-detection devices to ensure that any OE items that may exist on the surface of the ground or protruding from the ground are located during the sweep.

#### 3.1.5.1.4 Subsurface Removal to Depth of Detection

The removal to depth of OE alternative may be a viable OE response alternative if the OERIA indicates that there is a high number of anticipated exposures to OE by the public below the ground surface.

The removal would extend to depths consistent with the EE/CA findings within a given area. Under this alternative, one hundred percent of an area would be cleared of surface and subsurface OE items (to the specified depth). Experienced, OE qualified personnel would perform removal activities associated with this alternative. A geophysical instrument would be used to perform surveys over established grids. This geophysical survey would identify subsurface anomalies and any surface anomalies not identified during the brush-clearing activities. Surface and subsurface surveys would be performed simultaneously.

USA will evaluate these four possible OE response action alternatives for each AOC to ensure that recommended OE response alternatives are specifically tailored for each AOC.

#### 3.1.5.2 Alternatives Analysis

USA will use the results of the qualitative risk analysis (OERIA) as a basis for the evaluation of the four OE response action alternatives. For each OERIA evaluation area, USA will evaluate the OE response action alternatives in terms of their effectiveness, implementability, and cost. The purpose of this evaluation is to identify the most appropriate OE response action alternatives for each evaluation area compatible based on current and projected future land use.

#### 3.1.5.2.1 Effectiveness

Effectiveness is a measure of an alternatives ability to reduce the potential for exposure to OE. It is generally a measure of an alternatives ability to meet the criteria of protection of human safety, compliance with ARARs, and long-term and short-term effectiveness.

#### 3.1.5.2.2 Implementability

Implementability is a measure of whether an OE response action alternative can be physically and administratively implemented, such as the ability to construct, excavate, or demolish. The alternatives are ranked by technical and administrative feasibility, local agency and community acceptance, and availability of services and materials.

#### 3.1.5.2.3 Cost

Cost considerations are made using detailed costing assumptions for implementing each of the OE response action alternatives. The exception is NDAI, which has no associated costs (excluding the cost of recurring reviews). The benefit of the investment in reducing risk will be considered when ranking the OE response action alternatives. This involves identifying the overall reduction in risk to the public versus the cost of implementing the alternative.

### 3.1.6 ENGINEERING EVALUATION/COST ANALYSIS REPORT

USA will prepare and submit an EE/CA report fully documenting the fieldwork and subsequent evaluations and recommendations in accordance with DID OE-010.01. The EE/CA report will describe the site history, the work conducted under this task order, conclusions as to the nature and extent of UXO at the evaluated sites, recommendations for future work, a qualitative risk analysis, an evaluation of response alternatives, and a recommended OE response action alternative. The report will be supported with accompanying maps, charts, and tables as necessary to fully describe and document all work performed and all conclusions and recommendations presented.

USA will submit Draft and Draft Final versions of the Phase III EE/CA Report for review and comment. A formal document will be issued to address comments on the Draft and Draft Final report. Upon acceptance of the response to comments on the Draft and Draft Final reports, USA will incorporate the responses into a Final Report. The EE/CA report will be developed. The report will include:

- **Executive Summary** that details project objectives and historical attributes, site characterization effort, results and conclusions and recommended remedial action and estimated cost.
- **Introduction** detailing project authorization, purpose and scope, TPP team roles and responsibilities, public participation, and other environmental contamination encountered at the site.
- **Site Description/Problem Identification** detailing site location, physical description of the site, historical site use, and current and reasonably anticipated future site use.

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- **Project Objectives** detailing TPP goals and concerns, project constraints, identification of possible response action alternatives, project objectives, and data quality objectives.
  - **Site Characterization** detailing the historical analysis, personal interviews, aerial photograph analysis, site characterization efforts performed, and the source, nature, and extent of OE at the project site.
  - **Risk Evaluation** detailing the Conceptual Site Model (CSM), the OERIA, and the results of the OERIA.
  - **Response Alternatives Evaluation** detailing identification of possible alternatives, description of the alternatives screening process, comparative screening of the selected alternatives, and comparative analysis of remaining response alternatives.
  - **Institutional Control Plan** defining Institutional Controls proposed for the project site and requirements for the implementation and maintenance of the controls.
  - **Recommended Removal Action Alternative** detailing the recommended response alternative for the project site, including requirements for implementation, recurring review, and cost.
  - **Quality Control** detailing QC measures, results, and lessons learned.

#### 3.1.7 ENGINEERING EVALUATION/COST ANALYSIS ACTION MEMORANDUM

Following approval of at the Final Phase III EE/CA Report, USA will prepare and submit an Action Memorandum in accordance with the most recent USAESCH guidance. As the primary decision document for the OE response action, the Action Memorandum serves the following functions:

- Substantiates the need for the response action.
- Identifies the proposed action.
- Explains the rationale for the response action selection.
- Documents that the appropriate process was followed in the selection of the response action.

USACE Honolulu District will publish a Notice of Intent and the public will be given a period of time to comment on the proposed action. Following the public comment period (normally a minimum of 30 days), the appropriate action will be implemented.

#### 3.1.8 ENGINEERING EVALUATION/COST ANALYSIS COMPLETION AND CLOSE-OUT

The project will be closed upon submittal and USAESCH acceptance of the Action Memorandum and subsequent acceptance of the final invoice. At the time of the development of this Work Plan, the schedule projects the completion of the EE/CA with the Action Memorandum in April 2005.

#### 3.1.9 TIME CRITICAL REMOVAL ACTION

The procedures outlined in this Work Plan apply to NTCRA. Should circumstances develop justifying the need for a TCRA; USA will develop procedures in accordance with USAESCH guidance.

### 3.1.10 FOLLOW-ON ACTIVITIES

Once the EE/CA is approved by the USAESCH, follow-on activities will be implemented. These will include the following:

**Risk Management Design.** A risk management design will be prepared consistent with the Action Memorandum.

**Risk Management Action.** The selected Risk Management Action will be implemented based on the approved design. For clearance actions, a clearance report must be prepared to document the clearance activities, OE items that are recovered and disposed of, and exposure data. A clearance certificate will also be prepared.

The schedule for implementing the selected risk management actions will be based, in part, upon available funding and the time associated with securing the funding. Other factors, such as safety issues and land development, will also be important considerations.

**Residual Risk Management Activities.** It is possible that additional OE may be encountered even after risk management actions have been completed. If this occurs, existing procedures may guide DoD response to protect human health.

If the public encounters potential OE on any former site, the local law enforcement authority will initially respond. The Department of the Army EOD Units, which are situated throughout the United States, are responsible for responding to incidents involving military ordnance on public/private property. The U.S. Army will respond at the request of the local law enforcement authority. If numerous items are found in a particular area, USACE Honolulu District should be contacted to determine if further action is warranted.

**Recurring Review.** The USACE Honolulu District will maintain responsibility for the residual risk at the site following implementation of the recommended OE response actions by performing recurring reviews (See Section 3.15).

## 3.2 IDENTIFICATION OF AREAS OF CONCERN

During the Phase I EE/CA, the USACE identified five areas (A, B, C, E, and F) on the Parker Ranch for OE characterization, based on historical military use and accounts of OE encounter. The USACE conducted field investigations in six designated areas primarily within the active Puu Pa Maneuver Area totaling approximately 521 acres. Upon review of the Phase I EE/CA data, the USACE identified additional areas for investigation under the Phase II EE/CA. The Phase II EE/CA investigation areas encompassed 93,343 acres and field investigations involved the excavation of anomalies identified by geophysical investigation within randomly placed sampling grids and meandering paths.

Based on the finding of the Phase II EE/CA, the USACE identified three areas for OE investigation in the Phase III EE/CA of the former Waikoloa Maneuver Area. Of these three areas, the USACE had previously identified two areas for investigation under the Phase II EE/CA. These three areas of concern include:

- Sector 15 – Hawaiian Homelands Area (Sector 8 in Phase II EE/CA, 11,070 acres in the northeastern portion of the former Waikoloa Maneuver area previously excluded from Phase II EE/CA investigation due to Rights-of-Entry constraints)
- Sector 16 – Area North of Kawaihae Road (3,000 acres north of the Kawaihae Road Area)

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Sector 17 – Area West of Queen Kaahumanu Highway (Sector 11 in Phase II EE/CA, 2,500 acres west of Queen Kaahumanu Highway previously excluded from Phase II EE/CA investigation due to Rights-of-Entry constraints)

### 3.3 GEOPHYSICAL PROVE OUT PLAN AND REPORT

This section of the document summarizes the Geophysical Prove-Out (GPO) and the results and systems recommendations documented in the GPO Letter Report for the Phase III OE EE/CA of the former Waikoloa Maneuver Area.

#### 3.3.1 GEOPHYSICAL PROVE-OUT

USA completed the GPO on the Waikoloa GPO plot established by USAESCH on 11 September 2003. This plot consisted of three adjacent 100' x 100' grids for a total area roughly 100' x 300'. The USAESCH seeded one of the grids (designated as the known grid in this report) and provided the ground truth for the seed items. The USAESCH seeded a second grid (designated as the unknown grid in this report) as a blind test grid. The third grid was the Government/Contractors' grid, where both the Government and contractors are able to seed additional items, following OE avoidance procedures. This grid is designated as the contractors' grid in this report.

USA also surveyed portions of the Waimea GPO on 11 September 2003. This plot also consisted of three adjacent 100' x 100' grids for a total area roughly 100' x 300'. The same grid designations as the Waikoloa GPO were used. The Waimea known grid was surveyed with the grid survey method. A transect survey was performed along two 300' lines through the center of all three grids. A Meandering Path survey was performed over the unknown grid.

The location and site maps for these areas are provided in the Draft GPO Letter Report (Appendix F).

USA deployed a team of four personnel for this GPO. The project team included:

- The Project Manager, Mr. Doug Ralston, also a Senior UXO Supervisor (SUXOS),
- The Project Engineer, Mr. David Synakorn
- The Site Geophysicist, Ms. Karen Lemley (NAEVA Geophysics)
- UXO Technician I, Mr. Adam Chionchio

For this GPO, USA deployed the following equipment:

- A Geonics EM61MK2 with the 1.0 x 0.5 meter coil and Allegro 4000 data logger
- A Trimble 4700 Real Time Kinematic Differential Global Positioning System (RTK DGPS)
- A laptop computer with:
  - Geonics' sensor software for downloading and exporting data
  - Geosoft's software for initial processing and field analysis

The GPO team deployed the EM61MK2 in stretcher mode for all survey work and in wheeled mode during anomaly reacquisition. The GPO team configured the EM61MK2 data logging to record all four bottom coil time gate data at a 10 Hz rate.

The project team positioned the base RTK DGPS at the Power Line survey control point for all work at the Waikoloa GPO. The project team used the northeast corner of

the Waimea GPO as the base RTK DGPS for all work at the Waimea GPO. The rover RTK DGPS logged data at a 1 Hz rate.

Following completion of the Waikoloa GPO, USA acquired some additional data at the Waimea GPO plot. The project team surveyed a set of transect lines over the center of the 300' plot. Additionally, the project team surveyed the entire known grid, and completed a meandering path transect over the unknown grid.

NAEVA performed final data processing and analysis at their corporate office in Virginia. USA also issued a purchase order to Geophysical Associates, at no cost to the government, to evaluate the effectiveness of geological basalt discrimination (basalt background noise has the same spatial and amplitude response as potential OE) using the four lower coil time gate data provided by the EM61MK2. The results of the basalt discrimination are provided under separate cover as an addendum to this report.

### 3.3.2 GEOPHYSICAL PROVE-OUT LETTER REPORT

USA prepared and submitted the Draft GPO Letter Report on 15 October 2003. This document is provided in Appendix F and details the results of the geophysical systems test.

USA is confident that the EM61MK2 will provide the detection required for this phase of the Waikoloa EE/CA. The integrated Trimble RTK DGPS also performed well and is recommended for this phase of the EE/CA.

The stretcher method of deploying the EM61MK2 is also recommended. This sensor deployment technique minimizes the adverse noise effects of the rough terrain, reduces the mechanical fatigue on the equipment, and shares the sensor/positioning load between two operators. Compared to the wheeled mode used during the anomaly reacquisition demonstration at the Waikoloa GPO, the stretcher mode would be more effective.

USA used the grid, transect, and meandering path transect survey methods during this GPO. USA recommends all three methods for area surveying/characterization during this phase of the EE/CA, as deemed appropriate by the TPP team.

The standard EM61MK2 data processing and analysis tools (a combination of Geonics, Microsoft, and Geosoft software) proved to be adequate for this GPO. USA recommends processing and analysis of all three bottom coil time gate channels. It is apparent from the analysis of both the Waikoloa and Waimea GPO plots that the project team will need to establish different anomaly selection thresholds for different survey areas, and possibly even within some areas.

## 3.4 MOBILIZATION

USA will stagger the mobilization of project personnel based on the proposed schedule. The goal of the mobilization phase is to ensure that all project personnel are prepared and properly equipped to perform applicable field activities. Mobilization activities include:

- Packaging, shipping, and inventorying required project equipment
- Coordinating upcoming field activities
- Coordinating with site personnel (e.g., security, safety)
- Organizing support facilities and test communications equipment

- Identifying and procuring any additional supplies and equipment required to perform the work
- Conducting site-specific training

#### 3.4.1 PERSONNEL

Table 3-2 depicts the anticipated number of field personnel to be mobilized on-site during each phase of field activity.

**Table 3-2. Field Personnel Mobilization**

Field Activity	Anticipated Personnel Mobilizations by Organization	Total Anticipated Personnel Mobilizations
<ul style="list-style-type: none"> <li>• Mobilization</li> <li>• Geophysical Equipment Test</li> </ul>	5 USA 3 Geophysical Sub 0 USACE	8
<ul style="list-style-type: none"> <li>• Location Survey</li> <li>• Instrument-Assisted Reconnaissance</li> <li>• Geophysical Survey and Anomaly Reacquisition</li> <li>• Intrusive Sampling</li> </ul>	20 USA 3 Geophysical Sub 1 USACE	24
<ul style="list-style-type: none"> <li>• Final Demobilization</li> <li>• Scrap Disposal</li> </ul>	4 USA 0 Geophysical Sub 0 USACE	4

#### 3.4.2 PROJECT EQUIPMENT

During mobilization, project personnel will:

- Package and ship corporate equipment items to the project site
- Coordinate with selected vendors for direct shipment of supplies and equipment
- Coordinate with USA contracting office for communications, administrative, and other support
- Coordinate with local agencies to accommodate site-specific security requirements (e.g., vehicle inspections)
- Perform maintenance and quality checks of the equipment to ensure that it is operationally ready.

#### 3.4.3 SITE-SPECIFIC TRAINING

As part of the mobilization process, the USA SUXOS and UXOSO will perform site-specific UXO training for all personnel assigned to this project. The purpose of this training is to ensure that all personnel fully understand the procedures and methods the UXO personnel will use to perform operations at the project site, their individual duties and responsibilities, and all safety and environmental practices/procedures associated with operations. USA will train all personnel on arrival at the project site. Training topics/ issues and responsibilities are as follows:

- All personnel will receive training on duties and responsibilities, ordnance recognition, and UXO safety precautions.

- All personnel will receive any additional training on the individual equipment they will operate while on site.
- All UXO personnel will receive detailed training on this Work Plan, SSHP, and site-specific Environmental Protection Plan.

USA will document all training activities using USA site-specific training forms. Prior to mobilization, all project personnel will receive Hazardous Waste Operations and Emergency Response (HAZWOPER) 40-hour/24-hour (or 8-hour refresher) training, as required. Additionally, all on-site personnel must be participating in a medical surveillance program and must have completed a pre-placement or annual physical examination that complies with the requirements of 29 CFR Part 1910.120. Additionally, project personnel must have been certified as fit to work by an Occupational Physician certified in Occupational Medicine by the American Board of Preventive Medicine, or one who, by necessary training and experience, is board-eligible. Documentation of the medical qualifications of personnel will be filed on site and will be provided to USAESCH personnel upon request. UXO personnel may be screened at any time for drugs in accordance with an approved UXO drug/alcohol abuse screening program.

#### 3.4.4 FIELD OFFICE

The field office will be serviced with hard-wired communication (two telephone lines, one fax line), electricity, and plumbed water. In addition, furnishings will include office furniture, telephones, a fax machine, two-way radios, lighting, laptop computers, and a printer. Trailer-mounted, portable toilets with hand-washing units will be provided for personnel in the field.

Wall space at the field office will be available for posting important health and safety information and mandatory employee notifications. For security reasons, keys to the office will be under the strict control of the USA Site Manager.

### 3.5 INSTRUMENT-ASSISTED GROUND RECONNAISSANCE

#### 3.5.1 OBJECTIVES

The objectives of the Instrument-Assisted Ground Reconnaissance effort at the Phase III EE/CA sectors are:

- To refine the CSM for the Phase III EE/CA sectors, residential and resort areas, State of Hawaii lands, and the areas surrounding the former Waikoloa Maneuver Area;
- To evaluate the presence and location of OE and UXO related items to identify the extent of potential OE risk at the former maneuver area; and
- To identify specific terrain and vegetation existing at the site for inclusion in the GIS.
- Collect data necessary to aid grid selection for digital geophysical mapping and intrusive investigations.

USA will use the data collected during the reconnaissance, along with existing archival data, to determine the amount and location of areas requiring geophysical investigation.

### 3.5.2 PROPOSED EQUIPMENT AND INSTRUMENTS

Reconnaissance equipment and instrumentation will, at a minimum, include a Personal Data Assistant (PDA), location determining equipment utilizing Global Positioning System (GPS) technology, an industry standard hand-held metal detector (e.g., Whites Spectrum XLT), and a digital camera. Table 3-3 lists the proposed equipment and instruments for the reconnaissance.

**Table 3-3. Proposed Equipment and Instruments**

Required Technology	Proposed Equipment and Instruments
PDA	Compaq iPAQ 3700
GPS	Trimble Pathfinder Pro XRS DGPS
Metal Detector	Whites Spectrum XLT
Camera	General Consumer Grade Digital Camera

### 3.5.3 QUALITY CONTROL

The field investigation includes instrument-assisted reconnaissance of the three Phase III EE/CA Sectors. USA will use the data collected during the reconnaissance to evaluate the degree of field geophysical mapping required for the EE/CA. The processed data will identify the footprint of OE material in the project area. USA will also collect data to identify specific terrain, archeological, and wildlife characteristics within the project area. USA will implement the control measures detailed in the following sections to ensure the quality of the collected data.

### 3.5.4 EQUIPMENT AND INSTRUMENT TESTING

USA will perform daily tests of instruments and equipment systems used during reconnaissance to ensure that the accuracy and reproducibility of the collected data is consistent with manufacturer's specifications.

The UXOQCS will observe the equipment pre-operation procedures and document results in the daily log. USA personnel will tag and remove equipment from service if daily equipment field checks indicate equipment malfunction and field repairs cannot be made. The UXOQCS will notify the SUXOS of defective equipment and request for expedited replacement. To minimize cost impacts due to faulty equipment, USA will maintain backup PDA, GPS, and metal detectors at the project site.

#### 3.5.4.1 Interfaced DGPS and PDA System Tests

USA will interface the DGPS with a PDA running ArcPad 6.0, which includes site aerial photographs, planned reconnaissance transects, property boundaries, and points of interest (Figure 3-2). USA will perform daily tests of the DGPS/PDA system above a known coordinate. A variance of +/- 1 foot is acceptable, and deviations above 1 foot will be cause for reexamination of the GPS planning software results using a current satellite ephemeris file and a project-specific coordinate.



**Figure 3-2. iPAQ 3700 with DGPS and Aerial Map**

USA will continuously monitor the DGPS/PDA system as it tracks the progress along planned reconnaissance transects. USA will document and correct any failure before operations commence. At lunch time and at the end of each reconnaissance day, USA will download the collected data to the project laptop computer. USA will overlay the DGPS track map onto the planned reconnaissance transects to assess area coverage and location accuracy.

#### 3.5.4.2 Geophysical Equipment Tests

USA will test the Whites Spectrum XLT each workday prior to field activities. This test will include a functions check and the location of a known anomaly within the GPO Test Plot or other known site anomaly (e.g. private property stake in the NW corner of the site). Once established, the known anomaly will be a seed item that meets the size and depth requirements necessary to determine the serviceability of the instrument (e.g., an M1A1 Spotting Charge buried 2 feet, horizontal, east/west).

The Whites Spectrum XLT functions check involves moving the on/off/volume/range selector switches through their various positions and determining their serviceability/functionality.

#### 3.5.5 EQUIPMENT CALIBRATION AND MAINTENANCE

USA will perform required equipment calibration (on a prescribed schedule) and recalibration (as necessary) in accordance with manufacturer recommendations or the owner's manual. USA will record calibration results and reasons for recalibration in the daily field logbook.

USA will coordinate scheduled maintenance of the following equipment in accordance with manufacturer recommendations or the owner's manual.

- Vehicles;
- Powered Equipment;
- Personal Protective Equipment;
- Communications Equipment;
- Geophysical, Navigational Equipment, and PDA;
- Handheld Metal Detectors;
- Emergency Equipment.

Replacement equipment will meet the same specifications for accuracy and sensitivity as the equipment removed from service. Repair or replacement of parts will meet the manufacturer specifications and recommendations. The UXOQCS will document and maintain records pertaining to the testing, repair, and/or replacement of equipment on site.

### 3.5.6 REQUIRED DATA

At a minimum, USA will collect location, terrain and vegetation data at maximum intervals of 200 feet along reconnaissance transects. In the event that certain items (e.g., OE, UXO, OE related scrap) or features (e.g., magnetic responses indicative of subsurface metallic objects, ground scars, craters) are encountered, USA will collect a digital photograph of the item or feature, document the location of the item or feature, and provide a brief description of the item or feature, significant metal detector response, and existing terrain and vegetation.

### 3.5.7 DATA COLLECTION

USA will perform the reconnaissance sweeps across the entire project site using both transect and meandering path survey methods. USA will collect data at a maximum 200 feet intervals along transects. The Site Map in Appendix B depicts the project site, property boundaries, and the proposed instrument-assisted ground reconnaissance transects. Table 3-4 provides the reconnaissance acreage and survey method for each Phase III EE/CA sector.

**Table 3-4. Ground Reconnaissance Acreage and Survey Method**

Sector	Sector Name	Sector Acreage	Recon Acreage	Survey Method
15	Hawaiian Homelands Area	11,070	264	Transects
16	Area North of Kawaihae Road	3,000	150	Transects
17	Area West of Queen Kaahumanu Highway	2,500	250	Transects & Meandering Path

The preliminary CSM has identified three separate areas that need to be investigated to define the extent of the potential OE risk at the project site. USA will use the information collected during this reconnaissance effort to refine the CSM that supports the Phase III EE/CA of the former Waikoloa Maneuver Area.

USA will document the location and description of ground scars, craters, fragments of OE related material, vegetation, and terrain. USA will collect this data in an iPAQ 3700 PDA connected to a Trimble Pathfinder Pro XRS DGPS for navigation and location purposes (Figure 3-2). USA will use the Whites Spectrum XLT metal detector during the fieldwork to determine if significant subsurface ferrous anomalies exist at the site. USA will record waypoints and digital photographs of any data that meets the data collection criteria.

USA will use the analog survey instrument on both fixed bearings transects and meandering path, as appropriate for each area of the Phase III EE/CA sectors. Proposed transects are spaced according to coverage acreage defined in the SOW and are depicted on the Site Map in Appendix B. This survey technique is favored for its flexibility and noninvasive nature.

USA will record the location of subsurface anomalies in the iPAQ 3700. Other than the scrapping of the topsoil to identify possible fragments of OE items, USA will not perform intrusive investigation during this reconnaissance effort.

USA will coordinate with representatives from USACE Honolulu District and applicable state and local agencies for historical and archeological data pertaining to the site. USA will incorporate the historical and archeological data into the EE/CA Work Plan and subsequent geophysical investigations will be performed outside the boundaries of identified historical and/or archaeological sites.

USA has coordinated with representatives from USACE Honolulu District and applicable State agencies for listings of endangered and/or threatened species within the site. USA will incorporate this data into the EE/CA Work Plan and subsequent geophysical investigations will be performed outside the boundaries of areas containing endangered/threatened flora and fauna.

### 3.5.8 DATA MANAGEMENT

#### 3.5.8.1 Electronic Records

USA will record electronic data in the iPAQ 3700. USA will use external battery power and will change the batteries every four hours. USA will keep the electronic data on site to update site maps and track completed work. USA will use the updated maps to plan subsequent field operations. At the end of the workday, the data from the iPAQ 3700 will be downloaded to a laptop computer for electronic data transfer to the USA Corporate Office in Tampa, Florida.

#### 3.5.8.2 Project Records

USA will retain hard copies of primary records for the former Waikoloa Maneuver Area in the project files located at the USA Corporate Office in Tampa, Florida. These records will include the Task Orders and any modifications, correspondence including minutes of meetings and monthly reports, draft submittals, responses to comments and final submittals, and correspondence received from USAESCH or other agencies. Electronic versions of working products will be retained within the USA Tampa network server. Access to USA servers is password controlled. Historic records and documents, previous study reports, and related items will be retained in working files located in the USA Project Manager's office. The GIS

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Manager will retain the GIS data in the Tampa GIS Server during the course of the project. Access is limited by password to authorized USA personnel.

#### 3.5.8.3 Field Records

During field efforts, USA will maintain field records in the project field office (hotel), with copies delivered weekly to the project files in Tampa, Florida. Following completion of the fieldwork, USA will deliver all field records to the project files in Tampa, Florida. Such records will include geophysical logs, geophysical data, daily summary sheets, and related field and daily logs.

USA will maintain a detailed account of all live OE/UXO items encountered during the ground reconnaissance activities. This accounting will include the location of the item with waypoints collected using DGPS and a digital photograph as part of the official project record. The UXO Tech III will provide specific details regarding the items found to include, but not limited to, specific nomenclature, type fusing, condition, external markings, etc. USA will also record the coordinates along transects and the ultimate disposition of the item. USA will complete an Environmental OE/UXO Accountability Form for each live/suspected UXO item encountered. The SUXOS will ensure the forms are included in the final accounting in the Final EE/CA Report.

USA will maintain a field logbook to record site activities and field data in a neat and legible manner. Logbooks will be bound and pages consecutively numbered. USA personnel will make logbook entries in indelible ink. USA will enter the following information during the course of the reconnaissance activities.

- Date and team location;
- Personnel and work performed;
- Equipment and instrument checks;
- Injuries and/or illnesses;
- Changes to work instructions;
- Work stoppage;
- Visitors;
- Other relevant events;
- Signature of Supervisor.

USA personnel may supplement logbooks and records by the using of preprinted forms (i.e. safety inspection forms, tailgate safety briefings, etc). These forms help to ensure uniformity of activities being conducted, inspected, and reviewed. Forms are provided in Appendix J.

### 3.6 GEOPHYSICAL INVESTIGATION PLAN

This Geophysical Investigation Plan will be used to provide details of the approach, methods, and operational procedures to be employed in performing geophysical investigations at OE sites identified during the Site Reconnaissance task. Survey equipment, survey techniques, and data processing will follow the recommendations in the Final GPO Report.

The objective of this task is to obtain geophysical data for use in an EE/CA that recommends and justifies appropriate OE/UXO removal alternatives for the site. Geophysical methods will be used to detect UXO that may lie buried underground, because these methods provide the only reliable means of detecting subsurface UXO items and allow a nonintrusive, controlled investigation of the subsurface that minimizes the potential for explosive hazards to personnel and the environment. The geophysical mapping data will be used to identify potential OE-related anomalies that will be intrusively investigated during the Intrusive Investigation task.

Approximately 20 acres of the surface area of the project site will be geophysically mapped using a time domain electromagnetic sensor integrated with RTK DGPS positioning, as demonstrated during the GPO. The geophysical data collected will then be analyzed, and the results will be used to identify the locations of significant subsurface anomalies (i.e., those likely to be OE items). Once the subsurface anomalies have been identified, their locations will be denoted for the OE sampling teams.

The geophysical team will (1) perform continuous tracking, checks, and adjustments of the field data for QC, and (2) establish efficient field procedures. Navigation and instrument position within the investigation area will be tracked and recorded using state-of-the-art RTK DGPS instrumentation. The Universal Transverse Mercator (UTM), Zone 5N coordinate system will be used and referenced to the National Geodetic Survey North American Datum of 1983 (NAD83 CONUS) with units in meters. The geophysical survey teams will maintain a daily log that details pertinent activities, survey path features, and field conditions encountered in the performance of the geophysical investigation.

The investigation will be conducted under the direction of a Project Geophysicist with 30 years of experience performing geophysical investigations, including UXO detection and mapping investigations. The USA Project Geophysicist will oversee the data collection and reduction processes to be used and will be responsible for reviewing the field data to assure complete coverage, measurement precision, and geophysical reasonableness of the survey results.

Each of the two geophysical survey field teams will consist of an instrument operator/geophysicist and an assistant to aid in tracking control. The instrument operator will be trained and experienced in collection of geophysical data with the specific instrumentation deployed. This experience will include procedures for initializing data loggers, data downloading, and QA documentation.

### 3.6.1 REQUIREMENTS

**UXO Safety.** During all initial fieldwork and all intrusive activities, the geophysical crew will be accompanied by a UXO Technician II. Prior to the survey crew entering an area potentially containing UXO, the UXO Technician II shall conduct visual surveys for surface ordnance and an electromagnetic survey of each intrusive activity site to ensure the site is anomaly free prior to the crew setting monuments or driving stakes.

**Personnel Qualifications.** All geophysical investigations will be managed by Mr. Al Crandall, a qualified geophysicist meeting the qualification requirements listed in DID OE-025.01. USA is subcontracting the geophysical work to NAEVA Geophysics.

### 3.6.2 SITE DESCRIPTION

#### 3.6.2.1 Geophysical Data Quality Objectives

Geophysical DQOs for this project are as follows:

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- Static Noise less than +/- 2.5 mV for time gates 3 and 4. Based on the GPO static test results, the following Noise DQOs for time gates 1 and 2 are: +/- 5 mV for time gate 1 and +/- 3 mV for time gate 2
  - Response to a known item within 20% of previous value(s)
  - Lag and latency (the time lag between sensor and position data reporting as a function of survey direction and speed) corrections applied to correct sensor positioning to within 1 sample interval
  - Location reoccupation accuracy within 20 cm (about 8-inches)
  - Repeat data amplitudes within 20% of previous data and peak locations within 0.5 m
  - Grid survey line spacing within 2-feet +/- 1-foot
  - Along-line sensor sampling density every 15-cm (6-inches) + 7.5 cm (3-inches)
  - Refer to the Section 3.6.7 for additional DQOs.

#### 3.6.2.2 Ordnance and Explosives Target Objectives

The OE target objectives for this task range from 37mm projectiles up to 105mm and 155mm projectiles, as tested in the GPO. Site Specific Project constraints for this task recognizes the rough terrain over most of the site, requiring that the sensor (EM61MK2) be deployed in the litter mode to minimize terrain-induced noise. Also the high basalt content, having spatial and amplitude signatures similar to the target objectives will result in a higher than normal false alarm rate. Survey areas adjacent to occupied buildings will also be subject to higher ambient noise levels and higher cultural clutter densities.

#### 3.6.2.3 Specific Areas to be Investigated

Specific areas to be investigated will be based on the idealized survey map included in this Work Plan and modified by the Site Reconnaissance results, as necessary. A combination of grid, transect, and meandering path surveys are expected. An ideal survey mission plan map is included as a general guide. Actual survey locations may be modified based on the Site Reconnaissance results. USA will utilize RTK DGPS to survey each survey boundary point. Ten percent of these points will be checked for accuracy by the local professional land surveyor, as a QC measure.

#### 3.6.2.4 Past, Current and Future Use

See Section 1.6 and Section 1.7.

#### 3.6.2.5 Anticipated Unexploded Ordnance Type, Composition and Quantity

See Section 1.8 and Section 1.9.

#### 3.6.2.6 Depth Anticipated

Bedrock in the project site is at a depth of approximately 10 to 40 inches below ground surface. In most of the areas, the anticipated depth of OE is expected to be less than normal, given the volcanic composition of the site geology. In the Hawaiian Homeland area, where top soils are deeper, more normal depths are expected for OE.

#### 3.6.2.7 Digital Topographic Maps

The USA GIS Manager will provide digital topographical maps for this investigation. All geophysical investigations will follow observations from Instrument-Assisted Ground Reconnaissance.

#### 3.6.2.8 Vegetation

See Section 1.5.4.

#### 3.6.2.9 Geologic Conditions

See Section 1.5.5.

#### 3.6.2.10 Soil Conditions

See Section 1.5.5.

#### 3.6.2.11 Shallow Groundwater Conditions

USA is unable to locate information concerning shallow groundwater at the project site. USA will make every effort to secure such information for inclusion into the final Phase III EE/CA Work Plan.

#### 3.6.2.12 Geophysical Conditions

The volcanic nature of the geology in this site is problematic. Electromagnetic signatures from Basalt concentrations can mimic the signatures expected from the target OE, both in amplitude and spatial extent. The degree to which this adversely affects the sensors depends on the top soil depth.

#### 3.6.2.13 Site Utilities

Site utilities may affect survey data if surveys are required in the vicinity of occupied buildings or along established roads or power lines. All of these conditions exist in the project site. However, Sector 15 and Sector 16 are mostly undeveloped and utilities are unlikely to affect geophysical data. USA will select grid in areas with minimal utility influence, based on the result of the Instrument-Assisted Ground Reconnaissance.

#### 3.6.2.14 Man-Made Features Affecting Geophysical Investigations

Man-made features potentially affecting geophysical investigations include old (volcanic) rock walls, buildings, roads with utility right-of-ways, power lines, and established recreational facilities (e.g. golf courses).

#### 3.6.2.15 Site-Specific Dynamic Events

Site-specific dynamic events such as tides, unusually strong winds, or other unusual factors may adversely affect the timely execution site operations. If these events occur, the USA team will attempt to schedule other project work that is not affected by these events.

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#### 3.6.2.16 Overall Site Accessibility and Impediments

Overall site accessibility and impediments include rights of entry on all private lands that require surveying. Known tourist seasons may have an adverse affect on site access.

#### 3.6.2.17 Potential Worker Hazards

Potential worker hazards include the following:

- Slips, trips, and falls due to the uneven and cobbled terrain on much of the site
- Exposure to potential UXO
- Exposure to sun and wind

### 3.6.3 GEOPHYSICAL INVESTIGATION

#### 3.6.3.1 Survey Type

A combination of fixed pattern grids, transects, meandering path survey types are planned. The location of these will be guided by the idealized survey mission plan and revised, as required, by site reconnaissance task results.

#### 3.6.3.2 Equipment

Two Geonics EM61MK2 sensors with 1.0m x 0.5m coils are planned, based on the GPO Report. The Trimble 4700 RTK DGPS (or equivalent), with two rover receivers, will be used for positioning sensor data, as demonstrated during the GPO. The equipment will be deployed by each two-person team with the sensor and GPS antenna mounted in litter mode, with the sensor's 1.0 m width deployed across-track.

All four EM61MK2 lower coil time gate data will be sampled at a 10 Hz rate, as demonstrated in the GPO. RTK DGPS data will be output and recorded at a 1 Hz rate in the same data logger.

Satellite planning software will be used daily to plan geophysical surveys during periods of predicted peak GPS performance (e.g. when 6 or more satellites are available elevations of 10 degrees above the horizon or more, and a Precision Dilution of Precision (PDOP) value of 6.0 or less. Other project activities will be planned for periods that do not meet these requirements.

Data processing system and techniques will follow those recommended in the GPO report. A field laptop PC will be used to download survey data from the data loggers and perform initial data quality checks with software supplied by Geonics. Survey data will be electronically transferred to NAEVA corporate office in Virginia for processing and analysis using standard PCs running a combination of Microsoft Excel and Geosoft OASIS Montaj with UX-Detect and the QA/QC modules.

#### 3.6.3.3 Procedures

Procedures will follow those demonstrated during the GPO:

- Morning health and safety briefing

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- Review satellite availability to plan optimum survey times
  - Base RTK DGPS setup
  - Mobilize to survey site
  - Morning and afternoon rover RTK DGPS Reoccupation QC test
  - EM61MK2 sensor warm-up (at least 5 minutes)
  - EM61MK2 sensor nulling on an elevated table with the bottom coil at least 4-feet above ground and level
  - Sensor positioning (e.g. GPS antenna location to coil center), within +/- 1 inch (2.54 cm) will be confirmed and recorded at the beginning of each survey day I
  - Morning and afternoon static background, cable shake, and known object (e.g. 2" tow ball) response QC test
  - Morning and afternoon cloverleaf test over known object (e.g. survey site marker) QC test
  - Morning Site survey
  - Morning repeat 100' line QC test on standard grid or straight-line transect surveys
  - Mid-day break, data download and QC check for position and sensor data quality
  - Afternoon site survey
  - Afternoon repeat 100' line QC test on standard grid or straight-line transect surveys
  - Afternoon data download and QC checks for position and sensor data quality
  - Demobilization from survey site
  - Base RTK DGPS recovery
  - Review survey progress and plan next day's activities
  - Charge all batteries overnight
  - Archive and transfer data to USA and the NAEVA Data Processor/Analyst
  - Process and analyze previous days data from both teams
  - Transfer Dig-Sheet to USA and the NAEVA field team

#### 3.6.3.4 Personnel

The USA Project Geophysicist has overall responsibility for this task. NAEVA Geophysics will provide two two-person teams to perform the field work, and a data processor/analyst to perform the data processing, and analysis, as demonstrated during the GPO. Each team will demonstrate their capability on a set of lines acquired over the known GPO grids at either Waikoloa or Waimea. This performance check will be repeated if survey personnel or equipment changes are made.

#### 3.6.3.5 Production Rates

NAEVA will field two two-person field teams. Each team is expected to survey an average of 2-acres per day for a survey period of five-days for a total of 20 acres. An aggressive schedule is proposed. In order to meet this schedule, the survey team will acquire data for three consecutive days.

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Data from these surveys will be processed and analyzed each day after surveying. By the end of the third survey day, anomaly selection results from the first two days of surveying will be available for reacquisition. The geophysical survey crews will shift to anomaly reacquisition for two days. This will allow the UXO Site Reconnaissance team to shift to intrusive operations, maintaining the required safe separation distance from all other personnel. The survey crew will return to acquiring the last two days of geophysical data and then complete the anomaly reacquisition task. This maintains the aggressive project schedule and keeps the survey crew on-site until all survey data has been evaluated for acceptable site coverage and data quality.

#### 3.6.3.6 Data Spatial Density

Sensor data will be sampled at a 10 Hz rate. At an average walking survey speed of 2.5 miles per hour, this equates to a data spatial density of 11 cm (4.4 inches). Survey lane widths for grid surveys or multi-line transects will be 2-feet.

#### 3.6.3.7 Instrument Standardization.

See Section 4.4.

#### 3.6.3.8 Data Processing, Corrections and Analysis

Data Processing, Corrections and Analysis will follow the routines demonstrate during the GPO as follows:

The project team will download the field survey data from the data logger and convert from \*.R61 file format to a \*.M61 format using Geonics' DATMK2 software. This software will also be used to perform initial QC checks on position and sensor data quality. Position data that does not meet the PDOP threshold of 6.0 or less may require resurveying. Sensor data with excessive drift or noise may have to be repeated with fresh batteries. The project team will then use Microsoft Excel to reformat the \*.M61 data files for Geosoft import, processing, and analysis. In Geosoft's OASIS Montaj, the project team will convert the WGS84 survey Latitude, Longitude positions to UTM Zone 5N, with units in meters.

NAEVA Geophysicist/Analyst will use Geosoft's OASIS Montaj to:

- Assess static background noise levels, and uniform response to a known test object (2" tow ball)
- Check data gaps along track and line spacing across track
- Check RTK DGPS positioning

The major data processing steps included:

- Drift correction filtering (a UX-Detect process) of each time gate,
- Leveling each time gate,
- Lag correcting each time gate,
- Removing the daily QC data from the survey file into a separate database, and
- Gridding the processed time gates

## 3.6.4 DATA ANALYSIS

The project team will perform analysis of the gridded data on Time Gates 1, 2, and 3, as recommended in the GPO report. A check of the GPO analysis results from the sum of all 4 time gates did not provide any improved detection, so the project team limited the analysis to the first three time gate channels. In the known GPO grid and in the contractors' GPO grid, the project team used the known seed item locations to determine an appropriate detection threshold for each time gate. For these surveys, the initial analysis will utilize the thresholds established for the Waikoloa GPO (Table 3-5). It is expected that the site geophysical conditions will change, both for the better (e.g. as in the Waimea GPO) and for the worse. Therefore we expect to adjust these baseline detection thresholds, based on actual site conditions.

TABLE 3-5. GPO DETECTION THRESHOLDS

Waikoloa	Waimea
Time Gate 1 threshold = 15 mV	Time Gate 1 threshold = 10 mV
Time Gate 2 threshold = 10 mV	Time Gate 2 threshold = 7 mV
Time Gate 3 threshold = 6 mV	Time Gate 3 threshold = 4 mV

The project team will use Geosoft's UX-Detect to initially select targets. The NAEVA Geophysical Analyst will manually review all of the selected targets to refine and finalize the target selection and generate the final target maps as Geosoft maps. The project team will then export the processed data and targets lists to ASCII format files for delivery.

## 3.6.5 ANOMALY REACQUISITION

The field crews who acquire the geophysical survey data will perform the anomaly reacquisition, using the same geophysical and positioning equipment. As described above, the reacquisition task will be staggered to make the most efficient use of personnel and equipment. After three days of geophysical surveying, the two survey crews will complete two days of anomaly reacquisition. This is done so that the crew completing the site reconnaissance task can immediately transition to intrusive operations. This conserves equipment and personnel by not requiring a separate anomaly reacquisition team and allows some time for the completed site reconnaissance task to influence the actual survey areas.

## 3.6.6 FEED-BACK PROCESS

During the intrusive operations, each anomaly type will be identified. The approximate weight will be logged along with any intrusive team comments. The anomaly location offset and direction from the refined reacquisition flag will be recorded, along with orientation, inclination, and depth to the anomaly top will be reported on the Geophysical Dig Sheet and Target History. The USA Project Geophysicist will review the results of each recovered anomaly and assess its validity with the respect to signature amplitude and location. If the recovered item is too small for the anomaly signature, the intrusive team will be asked to reinvestigate that location. If persistent location offsets are discovered, the sensor positioning will be adjusted and the data reprocessed and analyzed. This will be done on a daily basis so that discrepancies can be addressed immediately.

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### 3.6.7 QUALITY CONTROL

QC will be maintained by performing the daily QC tests described in Section 4.4. The results of these tests will be evaluated against the project DQO for the geophysical investigation at this site include the following:

1. Geophysical data (both sensor and positioning) are of sufficient quality to support the reliable detection of hand grenades, 60 and 81 mm mortars, 75 mm projectiles, and 105 mm and 155 mm projectile fuzes, 37 mm anti-tank projectiles, and 4.2 inch mortars.
  - Sampling Density DQO: For EM data, along-track sampling densities do not exceed 0.5 feet and across-track line spacing does not exceed 3 feet (2+1 foot) or the across-track width of the sensor, whichever is smaller. Geosoft OASIS montaj QA/QC module will be used to verify these DQOs are being met.
2. Area coverage by the digital geophysical mapping is near 100%. All areas not covered by Digital Geophysical Mapping (DGM) will be documented. These missed areas will either be resurveyed or additional area surveyed so that the total area meets or exceeds the 20-acre requirement.
3. Data processing and analysis are performed uniformly and that selected anomaly locations are of sufficient accuracy for effective reacquisition and investigation
  - Instrument Latency DQO: Instrument latency will be corrected using an appropriate routine that accounts for instrument latency time and sensor velocity. Corrections will be specific for all segments of data with equal sensor velocities. No “zig-zag” or “chevron” effects are visible in data maps when plotted at the scales used to detect the smallest amplitude signal for any given UXO item expected at this site. The daily “clover-leaf” QC test will be evaluated to verify that the appropriate lag correction is being applied and that the RTK DGPS is positioning the sensor data correctly.
  - EM Leveling DQO: For any given dataset of EM data, all data channels will be leveled using the same routines and the same parameters, if necessary, data channel leveling is a processing step that is used to compensate for sensor output offset and drift and to improve anomaly analysis.
  - Processing DQO: All processing performed to produce final datasets (including processing to level the data) will be evaluated, on a dataset by dataset basis, to confirm that those routines do not significantly alter the original measured peak responses (above background) over anomalies. For producing final EM61 datasets, processing routines shall not alter the peak response of anomalies by more than the lesser of 5% or 5 mV. This DQO does not apply to any advanced processing that may be performed as part of anomaly selection processes.
  - Anomaly Selection DQO: The senior geophysicist or one of his/her designates, will certify that all anomaly selections have been performed or reviewed by them and that they accept the anomaly selections as reasonable for the intended purpose of this project.
  - Navigation DQO: The sum of all data positioning errors in the final datasets will not exceed +/- 1 foot. This DQO is specific to the reported positions of the UTM coordinates for each data point in the final version of geophysical data. This DQO does not include the accuracy of reported coordinates for selected anomalies. The purpose of this DQO is to ensure that proper field procedures are developed and used to minimize navigation errors and to identify any errors early in the event they occur. Typical sources of navigation errors

include inadequate satellite availability (planning software), inaccuracies in placing survey markers, the underlying assumptions of the merging processes used to merge navigation data with sensor data, inaccuracies associated with offset correction assumptions, and inaccuracies in dead-reckoning. The daily "clover-leaf" QC test will be evaluated to verify that the appropriate lag correction is being applied and that the RTK DGPS is positioning the sensor data correctly.

4. Data management provides accurate tracking, archiving, and delivery of all data (raw sensor and positioning, processed sensor and positioning, and analysis results).

#### 3.6.8 CORRECTIVE MEASURES

Sensor and position data that fail to meet the project DQOs will result in resurveying. Errors in data processing and analysis will require reprocessing and may require reanalysis of particular data sets. Intrusive results that clearly do not compare with the dig-sheet predictions will either require an analysis reassessment or a return to the anomaly location for further intrusive investigation.

#### 3.6.9 RECORDS MANAGEMENT

See Section 2.6 for the project schedule. Data will be downloaded from the survey data loggers twice each day. This raw data will be archived and transferred to USA and to the NAEVA Data Processor each evening.

#### 3.6.10 INTERIM REPORTING

USA and NAEVA will maintain daily logs. USA will use these logs to generate a weekly report. USA expects no more than two weekly reports will be required to document the geophysical investigations. USA will forward raw ASCII survey data to USAESCH within 36 hours of each survey day. USA will forward processed data and Excel dig-sheets to USAESCH within 48 hours of each survey day. USA will forward excavation results to the USAESCH within 24 hours of each investigation day.

#### 3.6.11 MAP FORMAT

All geophysical maps will conform to the current DID, Attachment D requirements, as demonstrated in GPO Letter Report.

#### 3.6.12 GEOPHYSICAL INVESTIGATION PERFORMANCE GOALS

OE detection depths for this project are based on the GPO results over known OE items at both the Waikoloa GPO and the Waimea GPO Known grids (Table 3-6). The USAESCH has additional information from the blind grids and from QC items they placed in the Contractors' grids, however, USA does not have these performance metrics.

Minimum OE diameter, based on the expected OE for this site is the 37mm projectile. These were included in the GPO.

Any unexcavated (missed) item having an intermediate principal axis diameter (with appropriate length) that fits within the target acceptance box included in DID OE 005-05.01 is considered a Quality failure. USA will, at no expense to the Government, correct the Quality deficiency and re-sweep and perform QC on all affected areas before re-submitting to the Government for verification and acceptance.

Table 3-6. Maximum Detection Depths

OE Item	Waikoloa Max. Detection Depth (")	Waimea Max. Detection Depth (")
155mm projectile	34"	N/A
105mm projectile	35"	31.7"
4.2" mortar	29"	38"
75mm projectile	21"	25.7"
2.36" rocket	16"	22"
60mm mortar	14"	19.4"
37mm projectile	9.5"	13.9"
Rifle grenade	11"	13.7"
81mm mortar	12" (Contractors' grid)	31.2"
Smoke grenade	N/A	No detects at 8.4" or 10.9"
Hand grenade (MKII)	N/A	14.5", but missed one at 11.3"
M48 fuze	N/A	5.1"

Based on the GPO results, USA believes that the expected depth of detection for the various OE items will vary over the site, due to changing geological conditions. If conditions improve (e.g. better than those at the Waimea GPO) detection depths may improve. However, USA expects that the geological conditions may degrade (e.g. worse than those at the Waikoloa GPO) over many portions of the site where the top soil layers are thin. As a practical consideration, the results of the Phase I and Phase II EE/CA investigations reveal that OE have only been recovered on or very near the surface and only explosive-driven fragments were found at any depth.

Based on the anomaly reacquisition demonstrated at the Waikoloa GPO, USA believes that the horizontal accuracy of 95% of all reacquired anomaly locations must lay within a one (1) meter radius of their original surface location as marked on the dig sheet is achievable. Due to the high basalt background expected throughout this site, USA is uncertain of our ability to meet the 0.35m refined anomaly location requirement for intrusive operations.

Base on the Waikoloa and Waimea GPO results, USA is confident that the 15% False Positive performance goal can be achieved. This is due to our nulling the EM61 MK2 in air and deploying the sensor in the stretcher mode, as demonstrated during the GPO. Our false alarm rate (metal objects or geologic features that mimic metal objects, but are not OE) range from 83.4% (6:1 ratio) and as low as 71.5% (3.5:1 ratio), due to the high basalt background and uncertain metal object background. For the Phase III EE/CA, anomaly selection thresholds will begin with those established

at both the Waikoloa and Waimea GPOs for each time gate, depending on actual site conditions. Experienced geophysicists will review each initially selected anomaly to assess its appropriateness across all four time gates. Anomalies that do not exhibit appropriate responses (e.g. time gate 1 > time gate 2 > time gate 3 > time gate 4) will be discriminated as noise. USA will continue to investigate advanced data processing and analysis techniques to improve our discrimination capability in high basalt conditions. The approach for this EE/CA is to rank selected anomalies by amplitude and begin investigating the high amplitude anomalies first. USA has proposed to investigate a total of 3,200 anomalies distributed over the site. This equates to 160 anomalies per acre. At this anomaly density, the 15% false positive rate will be achievable, and the false alarm rate could drop below 50%.

### 3.6.13 GEOPHYSICAL MAPPING DATA

USA has hired a local professional land surveyor (PLS) to identify available third-order monuments and survey markers throughout the site. In areas to be investigated where no monument exist, the PLS will establish a convenient monument with a minimum of "third-order" accuracy. These monuments will be used as RTK DGPS base stations to correlate all sensor data with navigational data. All sensor data shall be preprocessed for sensor offsets, latency corrections, drift corrections, etc. and correlated with navigation data. The approved geophysical mapping technology will digitally capture the instrument readings into a file coincident with the RTK rover DGPS coordinates, as demonstrated during the GPO. All raw and final processed data will be delivered corrected and processed in ASCII files. Corrections such as for navigation, instrument bias will be applied. All corrections will be documented. Geophysically mapped grids, transects, and meandering paths will be exactly coincident with the geophysical survey mission map or as redirected by the site reconnaissance results. The NAD83 CONUS UTM coordinate system, with units in meters, will be utilized, as demonstrated during the GPO. The delivered data will be presented in delineated fields as x, y, z, v1, v2, etc., where x and y are UTM Grid Plane Coordinates in Easting (meters) and Northing (meters) directions, z (elevation is an optional field in meters), and v1, v2, v3, etc., are the instrument readings and processed channel results. At least one field will be a time stamp. Each data field will be separated by a comma. No individual file will be more than 100 megabytes in size and no more than 600,000 lines long. Each file of data will be logically and sequentially named so that the file name can be easily correlated with the investigation area name used by other project personnel. No later than 36 hours after collection, USA will furnish each day's data to USAESCH, via internet using FTP, E-mail attachment for small files under 5 Mb, or digital compact disk delivered via FedEx, for inspection. Such data is considered to be in draft form. This data will be corrected for sensor offsets, latency, and drift. USA will also provide a digital planimetric map, in Geosoft format, and coincident with the location of the geophysical survey, so that each day's geophysical data set can be registered within the original mission plan survey map. Within 3 days after collection, USA will furnish interim dig sheets for each day's data to USAESCH via email. Within 14 days of completion of survey activity USA will provide USAESCH all final geophysical maps, dig-sheets and supporting geophysical interpretations. All geophysical data will be accompanied by a Microsoft Word 6.0 or higher file documenting the field activities associated with the data, and the processing performed. Draft Data will be provided within 24 hours of request to the government representative performing QA activities on the project.

**Geophysical Data Analysis, Field Reacquisition, and Reporting.** Please refer to Sections 3.6.4 through 3.6.10 above. USA will analyze the geophysical data and

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provide complete digital "dig-sheets" in Microsoft Excel spreadsheet format utilizing the current DID Attachment C.

**Anomaly Reacquisition and Marking.** Please refer to Section 3.6.5 above. USA will utilize NAEVA, the same Contractor that geophysically mapped and analyzed the survey area, to reacquire all geophysical anomalies identified for excavation on the dig sheets using the re-acquisition method tested by USA/NAEVA and approved by USAESCH on the GPO. NAEVA will flag (polyvinyl chloride flag marked with a unique identifier number in indelible ink) the actual field location of each re-acquired anomaly shown on the "dig-sheet" and paint the ground (if feasible and allowable) at the flag location with high-visibility paint. Anomaly reacquisition will be carried out concurrently with other site activities and will be completed no later than 3 days after geophysical field investigations are completed. USA/NAEVA will record and report on all discrepancies between final reacquired mapped locations of anomalies as shown on the dig-sheet, and actual locations of the excavated anomalies. USA will also report any anomalies that could not be reacquired.

**Anomaly Excavation Reporting.** USA will, in full accordance with the project Work Plan, excavate the reacquired anomalies in the field. The disposition and final location details of each anomaly will be recorded on the final dig sheets, which will be submitted to the USAESCH within 10 days of completed excavations for each individual investigation area and also submitted in the EE/CA Report Final Report.

### 3.7 LOCATION SURVEYS AND MAPPING PLAN

This chapter details procedures that USA will use to perform location surveying and mapping during the Waikoloa EE/CA. USA developed this plan in accordance with DID OE-005-07.01. USA will use a professional land surveyor to install two (2) 3<sup>rd</sup> order control monuments within the EE/CA project area in order to ensure survey control in all work areas. USA will use internal resources to survey grids and transects during EE/CA operations. The USA survey crew will use a Trimble RTK DGPS system with centimeter accuracy to capture the coordinates of grid corners, transect start and end points as well as intermediate transect points. USA will use a professional land surveyor to QC approximately 10% of all coordinates captured by USA to ensure their accuracy. USA will also use internal resources to conduct ground reconnaissance operations. During ground reconnaissance, USA will use a Trimble Pro XR DGPS will be used that is capable of 1 meter accuracy.

#### 3.7.1 UNEXPLODED ORDNANCE SAFETY PROVISION

During all field survey work, a UXO Technician will accompany the survey crew to conduct a visual survey for surface ordnance and a magnetometer survey in areas of intrusive work (e.g., driving stakes or setting monuments and control points).

#### 3.7.2 CONTROL POINTS

To the maximum extent possible, USA will utilize existing monuments to establish survey control. USA has identified that sectors 16 and 17 may have a control monument density that is insufficient to provide adequate survey control; therefore USA will install two new survey monuments, one in each sector. Concrete monuments will be located within the project limits, set a minimum of 10 meters from the edge of any existing road in the interior of the project limits, and a minimum of 300 meters apart. The top will be set flush with the ground and the bottom a minimum of 0.6 meters below frost depth. All new monuments will conform to the following accuracy and marking specifications:

### 3.7.2.1 Accuracy

Horizontal and vertical accuracy of Class I, Third Order, or better will be established for new control monuments. Horizontal control shall be based on either the English or metric system and referenced to both the NAD83 and the UTM System. Vertical control, if required, will also be based on either the English or metric system and referenced to the North American Vertical Datum of 1988 (NAVD88).

### 3.7.2.2 Monument Caps

Monuments will be capped with a brass, bronze, or aluminum alloy disk having a diameter of between 3 ¼" to 3 ½". The caps will be stamped in a consecutively numbered sequence and the identification number and coordinates will be stamped into the caps with dies of 1/8" to 3/16'.

### 3.7.2.3 Description Cards

USA will provide a "Description Card" for each control point and a tabular listing of all control points established or used for the project. These documents will be prepared during survey operations, submitted as completed with Weekly Reports, and will be maintained and provided in the Final EE/CA Report. The description card will depict the location of the monument, contain a north arrow, provide instructions on how to find the point (as referenced from other highly visible objects such as road intersections), identify the monument by number and identify the final adjusted coordinates and elevation for the monument in meters and feet (to the closest 0.001m and 0.01ft.) Description cards will be prepared on 5 by 8 inch cardstock and contain the identification data for a single monument.

## 3.7.3 MAPPING

USA will prepare maps/drawings of the project site that identify the relative location of the project site, the boundaries of each work area, and the grid pattern used to control execution of the work. The location, identification, coordinates, and evaluations of all primary control monuments recovered or established at the project sites will be plotted on a reproducible planimetric map of the site at an appropriate scale. Each control point will be identified on the map by its name or number and the final adjusted coordinates referenced to the UTM Coordinate System. Each map will include a grid north, a true north, and a magnetic north arrow with the differences between them shown in minutes and seconds. Grid lines in meters at systemic intervals with grid values will be shown on the margins of the map. In addition, a legend showing the standard symbols used for the mapping and a map index showing the site in relationship to any other sites within the limits of the project area will be shown. Boundary limits of the sites, the cleared areas, location of OE, will be plotted and identified on the map. A tabulation of all UXO located will note the identification number, the coordinates referenced to UTM Coordinate System, and a description of the item. The description will include whether it was found on the surface or subsurface and if subsurface, the depth. In cases of multiple OE items within a small area, the coordinates of the corners of the area will be shown.

A tabulated list of grid corners in UTM coordinates will be submitted in a Microsoft Excel Spreadsheet, version 98 or higher. OE location data will be submitted in a Microsoft Excel Spreadsheet, version 98 or higher and will include: grid number where found, item number assigned, type of item, location in UTM coordinates to the nearest foot, and depth below ground surface.

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### 3.7.4 DIGITAL DATA

#### 3.7.4.1 General Design File Requirements

Digital text files will be Word 97, IBM PC compatible. The drawing and plot data will be provided in UTM Coordinates and submitted in ESRI ArcView compatible format (as specified in the SOW). Three copies of all the data will be provided for formal submittals and will be submitted on PC CD-ROMs.

#### 3.7.4.2 Requirements

Each sheet will be 33.1 inches by 23.4 inches (standard "D" size drawing), and have a revision block, title block, index sheet layout, legend, grid lines, grid tic layout, scale bar, and a true north, magnetic north, and grid north arrows with the differences shown in minutes and seconds. In general, the direction of north will run from the bottom of the file to the top, with no skew.

A sheet index for the project will be prepared that includes enough of the planimetric data to indicate the sheets geographical location in the project area. This index will show all the data in the project and will be shown in each legend, with the current sheet crossed-hatched or heavily outlined. If required, a separate sheet file may be utilized for the index.

#### 3.7.4.3 Compatibility

Digital data submitted will be compatible with the USAESCH Graphics System.

#### 3.7.4.4 Digital Format for Survey/Mapping Data

All GIS data will conform to the Tri-Service Spatial Data Standards.

### 3.7.5 ITEMS AND DATA

The following items will be provided to USACE:

- Field Survey: Copies of field books, layout sheets, computation sheets, abstracts, and computer printouts. These items will be suitable bound, and clearly marked and identified.
- Control Points: A tabulated list of control points established or used for this survey showing the adjusted coordinates in feet.
- Located Items: A tabulated list of items located in the field.
- Description Cards: A "*Report on Establishment of Survey Mark*" (description card) for the permanent primary control monuments established or used for the survey.
- New Items: All unique items created or used to create the final products and the narratives and descriptions required by SOW.
- Maps: Maps will be submitted which show the locations of the areas searched, the search pattern, and the significant findings, as well as significant surface features within and adjacent to the project area. The scaling on the maps will be no greater than 1 inch equals 400 feet and will follow the standard "D" (33.1 inches by 23.4 inches) size drawing.

### 3.8 GEOGRAPHICAL INFORMATION SYSTEMS PLAN

USA will incorporate the archival data into the GIS created from the USAESCH GIS standard. The project will be conducted using a contractor workstation. The GIS data will be in ERSI shapefile and coverage format (ArcGIS 8) and maintained in accordance with DID OE-005-14.01. USA will ensure all GIS data is compatible with the USAESCH system. USA will transfer digital copies of the GIS files, data structure, and data to USAESCH when appropriate and as part of the final report.

#### 3.8.1 RESPONSIBILITIES

This section outlines the responsibilities of the GIS Manager for this EE/CA. Maintaining strict controls over data input, data management, data access, and data output is paramount in order to ensure integrity of the project database.

##### 3.8.1.1 Geographic Information Systems Manager

The responsibility for management and control of the project GIS will reside with the USA GIS Manager. The GIS Manager will:

- Direct GIS operations occurring locally and remotely,
- Design or approve the database relationships and physical storage format of data;
- Responsible for assigning storage locations of data; and
- Be responsible for control of data included in and used as part of the project GIS.

##### 3.8.1.2 Geographic Information Systems Database

The GIS database will be maintained on a computer system that provides for control over data access. A system administrator will be appointed and made responsible for direct day-to-day control over the system. The system administrator will be responsible for data integrity and database management and security. The systems administrator will follow the direction of the GIS Manager for granting access to and privileges on the database to authorized individuals.

#### 3.8.2 PROCEDURES

For this project, USA will establish and maintain a GIS to plan, record, query, analyze, report findings and project status. USA will operate and maintain the GIS and its related database at its corporate headquarters, located in Tampa, Florida. Field data will be transferred to our corporate headquarters via hard copy records and electronic data transfers.

Database files associated with GIS data will be delivered in either MS Office format or Adobe PDF format; GIS data will be delivered in ESRI format.

#### 3.8.3 GEOGRAPHIC INFORMATION SYSTEMS

USA will incorporate the archival data into the GIS created from the USAESCH GIS standard. The project will be conducted using a contractor workstation. The workstation will consist of 1.8 GHz computers with 512Mb of RAM, 120Gb hard drive, CD-ROM, and CD-ROM re-writer running on the Windows 2000 platform. The GIS data will be in ERSI format (ArcGIS 8) and maintained in accordance with DID OE-

005-14.01. USA will transfer digital copies of the GIS files, data structure, and data to USAESCH as part of the final report.

#### 3.8.4 DATA MANAGEMENT

GIS data management requires a daily effort from all GIS personnel. Management of field data will be the joint responsibility of the Project Manager and the SUXOS. All integration and analysis of data will be completed at the Tampa office under the direction of the GIS Manager.

#### 3.8.5 DATA RECONCILIATION

The GIS database will be maintained on the USA GIS workstation in Tampa, Florida. As data are added, updated, changed, altered, or manipulated in any way, reconciliation of the database is critical. The procedural details of this reconciliation are outlined in the Data Source Evaluation portion of this plan.

#### 3.8.6 DATA MAINTENANCE

As discussed above, the GIS database is maintained in Tampa, Florida. The GIS Manager will manage the database. This database is used to store preliminary and final or published versions of project GIS data. It is the official project repository of GIS data, including unprocessed feature and attribute data sources that may be used outside the GIS. The Tampa based database is the main location for processing data sources into draft and final GIS products as well as production work. A system of data entry and creation will be developed for insertion of data into the project GIS. This will be a set of steps that can be reproduced in order to ensure a consistent and standardized database. Existing data will be imported into the GIS and, if needed, will be modified so that it is consistent with the project data standards.

#### 3.8.7 DATABASE STRUCTURE

The GIS Manager is the decision point for determining how data will be stored in the GIS. The GIS Manager is responsible for designing or approving the database relationships and physical storage format of data to be include in the GIS. These data include feature, attribute, graphic, and non-graphic sources. Until this determination is made, no processing of newly acquired data may occur.

#### 3.8.8 DATA SOURCE EVALUATION

The GIS Manager is responsible for evaluating the appropriateness of data to be included in the GIS. All acquired data, regardless of media format, is to be sent to the GIS Manager for review and evaluation prior to processing. When acquisition of new data sets requires purchase from a vendor, personnel involved in the acquisition shall make every effort to obtain metadata or sample data sets prior to acquisition. This sample set or metadata will be evaluated by the GIS Manager to determine its suitability to meet the project needs.

#### 3.8.9 INVENTORY

Data is to be logged in as it is received for processing by filling out a metadata sheet. Metadata sheets are to be controlled by the GIS Manager for the various work sites. Metadata sheets are to be forwarded to the GIS Manager for review, record keeping purposes and insertion into the database.

#### 3.8.10 PHYSICAL DATA STORAGE

The GIS Manager is responsible for assigning storage locations of data received for inclusion in the GIS. Data are to be stored on the Tampa GIS file server in pre-approved directory paths dedicated to the Phase III EE/CA of the former Waikoloa Maneuver Area.

#### 3.8.11 SYSTEM ADMINISTRATION

The Waikoloa GIS field database is to be backed up locally by the SUXOS or designated UXO Supervisor performing the field operations. Digital CD-ROMs containing newly acquired or processed data are maintained as part of the archive database.

#### 3.8.12 DATA TRANSFER STANDARDS

The GIS Manager is responsible for establishing data transfer standards. The project GIS database requires adherence to authorized transfer standards, USAESCH GIS standards, and the Tri-Services Computer Aided Design and Drafting (CADD)/GIS standard. Data prepared at field sites will conform to these data transfer standards. Preferred data formats are ESRI shapefiles and coverages for smaller files and ArcInfo Interchange (.e00) files for larger files. All data incorporated into the project GIS will comply with the guidelines set forth in the CADD/GIS Technology Center Spatial Data Standards.

Data will be in the UTM coordinate system; Zone 5, NAD83, and units in meters. Data sets will include features required in Section 3.7: Location Surveys and Mapping Plan.

The GIS Manager will approve all naming conventions for data produced with GIS software products. Oversight of naming conventions is required in order to ensure that project file path/location pointers can be used when accessing data on the GIS system.

#### 3.8.13 METADATA

Metadata will be created that will describe each GIS data source maintained in the GIS database. The metadata will contain information about the data source, its location, where it originated, how it is structured, key attributes, and other miscellaneous items of interest to the project team. Those responsible for providing this metadata include the GIS Manager, Project Manager, and SUXOS.

#### 3.8.14 DATABASE RECONCILIATION

A single common GIS database will be maintained in the Tampa office. All data provided by site or another agency must adhere to the Tri-Service CADD/GIS standard and be approved by the GIS Manager.

### 3.9 INTRUSIVE INVESTIGATION

This section provides a description of OE field operations and details specific procedures applicable to the intrusive investigation at the project site. USA UXO qualified personnel will perform all OE sampling and disposal activities.

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### 3.9.1 GENERAL METHODOLOGY

USA personnel will perform all OE operational activities at the site under the supervision and direction of UXO qualified personnel. All non-essential personnel are prohibited from performing operations within the Minimum Separation Distance (MSD) radius. Throughout operations, USA UXO personnel will strictly adhere to the following general practices. Detailed UXO safety precautions and procedures are provided in the SSHP (Appendix D).

#### 3.9.1.1 Work Hours

Operations will be conducted during daylight hours only. The daily work schedule will consist of 5 consecutive 8-hour days or 4 consecutive 10-hour days, depending on work, site conditions, and productivity requirements. Under no circumstances will UXO personnel work more than 10 hours in any 1 day or more than 40 hours in any 1 week.

#### 3.9.1.2 Site Access

The USA SUXOS will control access into operating areas and will limit access to only those personnel necessary to accomplish the specific operations, or to those who have a specific purpose and authorization to be on the site. No intrusive operations will be conducted when unauthorized persons are in the vicinity of the investigation and sampling areas.

#### 3.9.1.3 Handling of Unexploded Ordnance

Only USA UXO qualified personnel will handle OE items. USA will closely supervise non-UXO personnel to ensure that they do not handle any OE. A UXO Specialist will inspect all suspect OE-related scrap prior to handling.

#### 3.9.1.4 Safety Training/Briefing

All on-site personnel will routinely participate in two types of safety briefings: a daily general briefing and a daily tailgate safety briefing. In addition, the SUXOS and the UXOSO may hold a safety stand-down at any time, when degradation of OE safety or any UXO-related safety issue that warrants a review is noted.

**Daily General Briefing.** The daily general briefing will be conducted for all personnel prior to beginning work. The briefing will cover general hazards for the project and any new safety issues or hazards that were identified after the last briefing. USA personnel will conduct the briefing, with input from the SUXOS, UXOSO, and/or USACE personnel, as appropriate.

**Daily Tailgate Briefing.** The SUXOS and the UXOSO will conduct tailgate safety briefings. A written record of this training and the signatures of personnel attending the training will be maintained. The training will focus on the specific hazards anticipated with each work site during daily operations and safety measures necessary to eliminate or mitigate those hazards. It will also refer to other operations within the area whose proximity may have safety ramifications. As work progresses and the team locations changes within a sector, or from sector to sector, any corresponding changes in ingress/egress and emergency evacuation routes will also be reviewed during this tailgate briefing.

#### 3.9.1.5 Visitor Safety Briefing

Site visitors must receive a safety briefing prior to entering the operating area and must be escorted at all times by UXO-qualified personnel. All visitors entering the project area must sign in at the field office.

#### 3.9.1.6 Environmental Awareness

Promotion of environmental awareness will be an ongoing part of daily general and tailgate safety briefings. Biological and cultural resources specialists will provide an environmental briefing prior to the initiation of field activities.

#### 3.9.1.7 Safety and Environmental Violations

Safety violations or unsafe acts will be reported immediately to the SUXOS and the USA Site Manager. Failure of UXO personnel to comply with safety rules/regulations or failure to report violations may result in immediate termination of employment. Reckless interference with sensitive species or blatant disregard for environmental issues will likewise not be tolerated and may lead to termination of employment and possible legal proceedings.

#### 3.9.1.8 Work Clothing and Field Sanitation

Work clothing will be appropriate for the conditions encountered. In most cases this will be Level D Personal Protective Equipment (PPE), as follows:

- Short- or long-sleeve cotton coveralls or work clothing.
- Sturdy footwear (e.g., ankle-high work boots). UXO personnel will not wear steel-toed safety boots when using geophysical equipment.
- Hand protection will consist of leather or canvas work gloves. Rubber inner or outer gloves may be required where increased protection is needed.
- Safety glasses with side shields, hearing protection, and hard hats will be available and worn during activities for which their use is required. Hard hats will not be worn during the excavation and demolition of OE items.

The team will be outfitted with field decontamination equipment, which will consist of portable eyewash kits, containers of wash water, paper towels, and soap. Prior to commencement of daily operations, these facilities will be in place and ready for use in the vicinity of the work area, as needed. Good housekeeping and decontamination measures will be practiced. The work teams will utilize portable toilets.

#### 3.9.1.9 Compliance with Plans and Procedures

UXO personnel will conduct operations at the site in a systematic manner using proven operating methods and techniques. All activities will be conducted under the direction, supervision, and observation of the USA SUXOS (or an UXO Supervisor during OE avoidance activities). All personnel will strictly adhere to approved plans and established procedures. When operational parameters change and there is a corresponding requirement to change procedures or routines, careful evaluation of such changes will be conducted by on-site supervisory personnel. Any new

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course of action or desired change in procedures will be submitted with justification for approval in accordance with the QC Plan. Approved changes will be implemented in a manner that will ensure uniformity in procedures and end-product quality on the part of the UXO team.

#### 3.9.1.10 Chemical Warfare Material

USA does not anticipate that chemical warfare material (CWM) will be encountered during field operations. If, during site operations, UXO personnel encounter a suspected toxic chemical munition or CWM, all project personnel will immediately withdraw upwind and contact USAESCH OE Safety and USACE Honolulu District, who will notify the appropriate agencies. USA UXO personnel will secure the site with two UXO Specialists until relieved by USAESCH-designated representatives (e.g., Technical Escort Unit).

#### 3.9.1.11 Equipment Checks

All instruments and equipment that require maintenance and/or calibration will be checked and logged prior to the start of each workday. If equipment field checks indicate that any piece of equipment is not operating correctly, and field repair cannot be made, the equipment will be tagged and removed from service and a request for replacement equipment will be placed immediately. Replacement equipment will meet the same specifications for accuracy and precision as the equipment removed from service.

OE avoidance support personnel or anomaly closure team personnel will use either EM conductivity meters, fluxgate magnetometers, or optically pumped cesium vapor magnetometers to ensure OE avoidance and anomaly-source investigation at the site. Instrumentation that will be used for either surface or subsurface OE detection will be tested at the Geophysical Equipment Test Plot established at the project site to verify that the instrument performance meets or exceeds that necessary to ensure safe performance of the work.

Instrumentation to be used for avoidance of surface OE will be capable of detecting a hollow-steel cylinder (nominally equivalent to a 20mm HE projectile) at a depth of 6 inches below ground surface.

Instrumentation to be used to clear locations for intrusive activities that will penetrate no more than 12 inches into the ground, such as setting sampling location stakes, will be capable of detecting a hollow-steel cylinder (nominally equivalent to a 37mm HE projectile) at a depth of 12 inches below ground surface.

Instrumentation used to verify that all sources for the identified geophysical anomalies have been removed from each intrusive sampling location will provide detection performance equal to that of the selected geophysical array, as verified at the field equipment test plot.

#### 3.9.1.12 Ordnance and Explosives Avoidance Support

USA UXO personnel will escort non-UXO personnel during performance of their duties within areas of potential OE risk. Activities most likely to require OE avoidance support include, but are not limited to, geophysical mapping, anomaly reacquisition, and biological and/or cultural resources surveys.

Project personnel will report all OE encounters to the USA Site Manager, and UXO personnel will mark all suspect OE subsurface anomalies for avoidance. A UXO Supervisor will be responsible for directing the actions of the UXO Avoidance Support Team. Throughout these operations, the UXO Supervisor will closely monitor performance to ensure that procedures are being performed with due diligence and attention to detail. Appropriate UXO-qualified personnel will perform UXO avoidance support for the operations described in the following subsections.

The following information will be recorded in a daily log by the UXO Supervisor for each suspected OE encountered and delivered to the USA Site Manager:

- The date the suspected OE item was encountered
- The date the suspected OE item was destroyed/demilitarized
- A description of the suspected OE item in standard ordnance terminology
- The location of the OE item, including the sector ID and transect position.

#### 3.9.1.13 Equipment

The equipment requirements for this activity include:

- Approved hand-held geophysical equipment used to detect subsurface metallic anomalies
- Miscellaneous common hand tools (e.g., screwdrivers)
- Pin flags listed in Table 3-7 (pin flag colors listed may change if they conflict with the colors used to mark anomalous areas).

**Table 3-7. Marking Color Code**

Color	Used to Mark
Red Pin Flag/Clay Pigeon	Danger, identified OE, special precaution required
Yellow Pin Flag/Clay Pigeon	Caution, suspect OE, unidentified subsurface anomalies
White Pin Flag/Clay Pigeon	Boundary or temporary marker

### 3.9.2 ORDNANCE AND EXPLOSIVES ACCOUNTABILITY AND RECORDS

#### 3.9.2.1 Ordnance and Explosives Anomaly Closure

The UXO Supervisor of the OE investigation team will ensure that all sources for the identified geophysical anomalies have been removed from

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each intrusive investigation during OE sampling. The UXO Supervisor will survey the location using an electromagnetic (EM) conductivity meter/metal detector. Survey data will be recorded in a bound field notebook and will include sampling lane or grid identity, anomaly identification number, and both peak and background responses on the instruments digital meter results. Notebook entries will be signed and dated by the individual performing the survey. Anomalies located during this survey will be reported and reinvestigated. In addition, the team will backfill excavations and restore ground surface.

#### 3.9.2.2 Records

The USA SUXOS will prepare and submit a detailed daily accounting of activities performed over each sampling lane and grid using the OE Sampling Excavation Information Sheet from Appendix J for each sampling lane or grid anomaly to be intrusively investigated. In addition, the SUXOS will provide the USA Site Manager with a daily summary of the following information:

- The date and time operations began
- The date and time operations were completed
- The number of hours, by labor category, expended in performing operations
- The type(s) and amounts of explosives used
- The number, type, and description of OE items encountered
- An estimated weight, in pounds, of the OE scrap metal removed from the site.

#### 3.9.3 ORDNANCE AND EXPLOSIVES PERSONNEL QUALIFICATIONS

UXO teams will consist of qualified personnel approved by USAESCH. Non-UXO qualified personnel will not perform any excavation nor handle OE/UXO. As required by the specific task, all USA personnel on this project will complete the Occupational Safety and Health Administration (OSHA) 40-hour training course for hazardous waste site workers. Additional site specific training, in accordance with 29 CFR 1910.120, EM 385-1-1 (USACE Safety and Health Requirements Manual), and ER 385-1-92 (Safety and Occupational Health Document Requirements for HTRW and Ordnance and Explosive Waste OE activities) will be provided to all personnel upon their initial mobilization. A Medical Surveillance Program will be in place with the latest exam within the last 12 months.

All personnel must meet the requirements set forth in DID OE-025.01 Personnel/Work Standards (dated 01 October 2002). UXO personnel will be U.S. citizens and graduates of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, Maryland; the U.S. Naval EOD School, Indian Head, Maryland; the EOD Assistants Course, Redstone Arsenal, Alabama; the EOD Assistants Course, Eglin Air Force Base, Florida; or a DoD-certified equivalent course. Credit for the EOD experience while assigned to the National Guard or Reserve will be based on the actual documented time spent on active duty, not on the total time of service. The following subsections detail individual UXO personnel qualifications.

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#### 3.9.3.1 Unexploded Ordnance Safety Officer

The UXOSO shall have the following skills/knowledge obtained through completion of the EOD Course, U.S. Naval EOD School, Indian Head, Maryland.

- The ability to identify fuzing, precautions that must be taken, fuze condition (i.e., armed, functioned or armed and functioning) how this condition can or will affect the munition payload should other forces be applied.
- The ability to recognize munition/ordnance types, determine the hazards, and make risk assessments. This includes identifying potential fillers including those in extremely deteriorated condition (e.g., high explosives, fragmentation, white phosphorous, and chemical warfare material). Must also be able to determine if munitions can be moved before destroying, or if the munition must be blown in place; fragmentation radius, or in the case of chemical warfare material, the potential down-wind hazard along with the engineering controls to mitigate both.

The UXOSO will have the same minimum prerequisites as the UXO Technician III. The UXOSO will also have the specific training, knowledge and experience necessary to implement the USA site health and safety plan and verify compliance with applicable safety and health requirements.

#### 3.9.3.2 Senior Unexploded Ordnance Supervisor

The SUXOS will have at least 15 years combined active duty in military EOD and contractor UXO experience, to include at least 5 years in supervisory EOD and UXO positions. This individual will have documented experience with and/or specialized training in the type of OE expected to be encountered. This individual will be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, Maryland or U.S. Naval EOD School, Indian Head, Maryland.

As the most senior UXO qualified individual onsite, the SUXOS directly supervises all daily UXO activities. This individual is responsible for the successful performance of field teams, early detection, and identification of potential problem areas, and instituting corrective measures. The SUXOS shall: execute instructions from the USA Site Manager; document site conditions; photographically document operations; prepare project reports; and identify efforts to accomplish the statement of work. The SUXOS reports to the USA Site Manager as well as to the USA Project Manager.

#### 3.9.3.3 Unexploded Ordnance Technician III

The UXO Technician III may supervises a UXO team. This individual will be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, Maryland or U.S. Naval EOD School, Indian Head, Maryland. This individual will have experience in OE clearance operations and supervising personnel. This individual will have at least 10 years combined active duty military EOD and contractor UXO experience.

#### 3.9.3.4 Unexploded Ordnance Technician II

This individual will be a graduate of the U.S. Army Bomb Disposal School, Aberdeen Proving Ground, Maryland or U.S. Naval EOD School, Indian

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Head, Maryland. The UXO Technician II may be a UXO Technician I with at least 5 years combined military EOD or contractor UXO experience.

#### 3.9.3.5 Unexploded Ordnance Technician I

The UXO Technician I will be a graduate of the EOD Assistant Course at Redstone Arsenal, Alabama, Eglin Air Force Base, Florida, or the EOD course at Texas A&M, College Station, Texas. The UXO Technician I will not perform UXO procedures without the direct supervision of a UXO qualified individual. A UXO Technician I may become a UXO Technician II if they have at least 5 years combined military EOD and contractor UXO experience.

#### 3.9.3.6 Unexploded Ordnance Quality Control Specialist

The UXOQCS will have the same minimum prerequisites as the UXO Technician III, as well as the required QC training. This individual must be able to fully perform all functions enumerated for UXO Sweep Personnel and UXO Technicians I, II, and III. This individual must have the specific training, knowledge, and experience necessary to fully implement the QC plans. In addition, the UXOQCS must have the ability to implement the UXO specific sections of the QC Program for all OE related evolutions; conduct QC inspections of all UXO and explosives operations for compliance with established procedures; and direct and approve all corrective actions to ensure all OE related work complies with contractual requirements.

### 3.9.4 ORDNANCE AND EXPLOSIVES SAMPLING LOCATIONS

Following the geophysical mapping and data analysis, the geophysical investigation team will reacquire anomalies and mark the OE sampling locations as detailed in the Geophysical Investigation Plan (Section 3.6).

### 3.9.5 ORDNANCE AND EXPLOSIVES SAMPLING PROCEDURES

Once the geophysical investigation team has identified and marked the locations of anomalies for intrusive investigation, the OE sampling team will investigate the selected anomalies. All potential OE-related anomalies will be excavated until a source is identified. The OE sampling teams will provide a description, including recovery depth and item orientation, of the discovered anomaly source and record (with sketch map) the offset distance and direction between the actual source center and the marked anomaly centroid in field log books.

Data describing the anomaly sources discovered during the intrusive investigation process will be recorded and provided to USAESCH at the conclusion of the data collection efforts. Recorded data will include, but not be limited to, size, estimated weight, orientation, depth below ground surface, and description of the item excavated.

USA will provide all equipment necessary to perform OE sampling over 20 acres distributed throughout approximately 16,600 acres in the Sectors 15, 16, and 17 of the former maneuver area. Geophysical anomalies will have been previously identified/flagged. The UXO personnel will intrusively investigate all anomaly locations as described below (unless removal of surface metallic debris is verified as accounting for the mapped geophysical anomaly). The UXO project team will consist of a SUXOS, the UXOSO, and three OE sampling teams, each consisting of a UXO Supervisor and four UXO Specialists.

### 3.9.5.1 Equipment

The equipment requirements for this activity include:

- Instrumentation (hand-held EM conductivity meters or magnetometers) used to assess proximity to subsurface metallic anomalies and/or OE during progress of excavation
- Miscellaneous common hand tools (e.g., screwdrivers, digging implements)
- Forms and logbooks to record activities and contamination levels
- Backhoe, if necessary
- Demolition equipment and explosives required for OE disposal, if necessary.

### 3.9.5.2 Ordnance and Explosives Surface Clearance

An OE surface clearance consists of a visual survey of the surface terrain to locate, characterize, and evaluate surface ordnance, potential residue, or evidence suggesting the presence of subsurface ordnance. The visual survey relies on a systematic progressive search pattern within the delineated search paths or grids. Each survey path will be 10 feet wide. UXO Specialists will assemble in line formation and advance at a slow, continuous pace, visually inspecting the surface of the search lane for OE and evidence of ordnance compounds in the soil (stains). As the clearance progresses, plastic pin flags or a wood lath will be placed every 50 feet along the outside line of the cleared path. When one transect is completed, the team will move to another and continue until all survey paths or grids are completely searched.

Each contact will be evaluated by a UXO Specialist to determine if the contact is OE or ordnance scrap. USA will mark all observed OE in place and record the position for end of day disposal by the demolition team. In the event that same day disposal cannot be performed, USA will secure the item during non-work hours as detailed in Section 3.10. Metallic scrap/debris greater than 1 inch by 2 inches will be moved at least 5 feet beyond the edge of the survey path, or in the case of a grid, all recovered metallic scrap/debris will be placed 5 feet beyond the southwest corner stake. USA will dispose of OE and ordnance scrap in accordance with Section 3.9.11.

### 3.9.5.3 Vegetation Clearance

USA does not anticipate the need for vegetation removal. If vegetation removal becomes necessary, clearance would be limited to removal of brush and/or tree limbs that would impede the progress of the geophysical mapping activities. USA will move and stockpile cut vegetation from the survey lanes. The stockpiled vegetation will not be removed from the project sites.

USA will hire local labor for any necessary vegetation clearance. Local laborers will perform the vegetation clearance under the supervision and escort of a UXO Supervisor. The vegetation clearance would follow the OE surface clearance and would be conducted using hand tools – no "brushhogs," flails, tractors, etc. The UXOSO would ensure that the

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vegetation removal operation was executed safely in accordance with the project SSHP.

#### 3.9.5.4 Anomaly Reacquisition

Anomaly locations will be reacquired in accordance with Section 3.6.5 prior to investigation by OE sampling teams.

#### 3.9.5.5 Ordnance and Explosives Investigation and Removal

All anomalies identified for sampling will be intrusively investigated, unless removal of surface metallic debris can be verified as accounting for the mapped geophysical anomaly. The OE teams will provide a description of the item to include recovery depth and item orientation, and record (with sketch map) the distance and direction between actual source center and the marked anomaly center in their field logbooks. Intrusive investigation excavations will continue until the anomaly source has been positively identified.

Excavation of anomaly locations will be performed in accordance with the procedures outlined in the following subsections. USA will document anomaly sources evaluated at depths greater than 3 feet below ground surface to establish need for extensive equipment and safety measures. Excavations requiring extensive measures to complete will be backfilled and delayed for a consolidated effort. Delayed excavations will be reported to the Site Manager as incomplete and scheduled for future excavation.

Preliminary grid locations have been identified for Sector 15 and Sector 17 (refer to the Idealized Geophysical Survey Mission Map in Appendix B). Actual grid locations will be identified using data collected during the instrument-assisted ground reconnaissance and taking into account terrain, cultural features, or other physical obstacles. During the field effort, MSDs will be established and maintained around each actual grid location.

For most areas in the Phase III EE/CA sectors, USA proposes meandering path geophysical survey transects, anomaly location along the transects, and use of grid surveys over areas of interest. Appropriate MSDs will then be established for anomaly locations to be investigated. This will be incorporated into the project GIS prior to intrusive investigation to ensure proper safety measures are implemented (e.g., temporary road closures, relocation of local residents). The GIS will be continuously updated and incorporated into the fieldwork planning.

**Near-surface anomalies** are those suspected to be within 1 foot of the surface that can be excavated using hand tools. These anomalies will be excavated by carefully removing the earth overburden using a hand shovel/trowel or other small digging implement. Throughout the excavation, the UXO Specialists will use a conductivity meter or magnetometer to check and verify the proximity of the anomaly.

**Subsurface anomalies** are those caused by sources that are more deeply buried or that may require excavation using heavy equipment (e.g., backhoe). For these excavations, a UXO Supervisor will coordinate equipment requirements with the SUXOS. Prior to the arrival of the heavy equipment, the UXO Supervisor will ensure that a cleared entrance and egress path is available for the heavy equipment. The UXO Supervisor will

designate one person to direct the heavy equipment operator. Heavy equipment (operated by a qualified UXO Specialist) or manual digging tools will be used to excavate the earth overburden in 6-inch lifts. After each lift, the anomaly location will be redefined with appropriate instrumentation and the anomaly source investigated using hand tools. This process will continue until the source of the anomaly has been uncovered and identified.

Before entering an excavation, the UXO Specialist must make eye contact with the backhoe operator. When a UXO Specialist is checking backhoe excavations for suspected OE-source proximity, the backhoe bucket will be placed on the ground and the operator will keep his/her hands clear of the operating controls. The backhoe operator will resume excavation operations only after visually verifying that all personnel are clear of the excavation and outside of the bucket swing area.

### 3.9.6 MUNITION WITH GREATEST FRAGMENTATION DISTANCE

USAESCH identified the Munitions with Greatest Fragmentation Distance (MGFDs) based on previous removal actions and UXO recoveries during the Phase I and Phase II EE/CA. USA identified the MGFD for the Phase III EE/CA sectors using the MGFD known to be used in or near each sector. In sectors where no OE items have been reported, USA used the MGFD for bordering sectors. Table 3-8 lists the MGFDs by sector and their associated MSD, as calculated by USAESCH in the MSD Worksheets in Appendix G.

**Table 3-8. Minimum Separation Distance by Sector**

Sector	Munition with Greatest Fragmentation Distance	Minimum Separation Distance (feet)
Sector 15	MKII hand grenade	650
Sector 16	155mm projectile	2,577
Sector 17	155mm projectile	2,577

### 3.9.7 MINIMUM SEPARATION DISTANCES

The MSD for intentional and unintentional detonations during the intrusive investigations are based on the MGFD for each Phase III EE/CA sector. The initial MSD for each sector is listed in Table 3-8. USAESCH MSD Worksheets are provided in Appendix G. The USA SUXOS will ensure the OE sampling teams are assigned to sectors/areas that will provide adequate safety distances from other OE sampling teams engaged in intrusive investigations. USA will take into consideration the suspected OE type in the specific sectors when separating teams; however, a minimum distance of 200 feet will be observed.

### 3.9.8 ORDNANCE AND EXPLOSIVES IDENTIFICATION

Any suspected or known UXO encountered during excavation will be clearly marked and its position annotated on the anomaly dig sheet and other appropriate site maps. The UXO Team Supervisor will evaluate the item found and immediately report the condition of the item to the SUXOS. No UXO will be moved without positive identification of the UXO item, an evaluation of its condition, and approval has been

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received from the USACE OE Safety Specialist or the item has been identified as non-UXO.

#### 3.9.8.1 Miniature Open Front Barricade

**Introduction.** This Standard Operating Procedure (SOP) is for use by USA personnel who are trained and assigned the task of using the Miniature Open Front Barricade (MOFB) in the performance of their duties. This SOP makes provisions for the use, storage, and inspection of this equipment. It is the responsibility of the assigned personnel using this equipment to know and follow all applicable requirements, guidance, and directives associated with this equipment and its intended use. This SOP is not a standalone document and will be used with other applicable reference material.

**References.** This SOP was prepared using the following reference material: HNC-ED-CS-S-98-8 Miniature Open Front Barricade;

- USAESCH OE-CX Interim Guidance Document 00-01 Determination of Appropriate Safety Distances on OE Sites;
- USAESCH OE-CX Interim Guidance Document 00-02 Basic Safety Concepts and Considerations for OE Operations;
- USA SSHP for the former Waikoloa Maneuver Area, Hawaii;
- Technical Manual 5-1300;
- Technical Manual 60A-1-1-31;
- Technical Manual 60A-1-1-22.

**Warnings and Precautions.** The following warnings and precautions will be adhered to by all personnel to ensure safe and proper use of this equipment:

- Only trained and authorized personnel will utilize this equipment;
- Safe separation distances will be observed at all times;
- Site control measures will be instituted and maintained at all times during operations;
- Operations will cease upon entry by any unauthorized or non-essential personnel;
- Violations will be reported immediately for corrective action;
- All appropriate ordnance and explosive safety precautions will be observed at all times;
- Plates will be installed one at a time during setup operations;
- Plates will be placed into the MOFB, never dropped in place;
- Extreme caution will be used when installing plates, as severe injury to fingers, hands, or feet could result;
- The MOFB will NOT be used within 200 feet of non-essential personnel or occupied structures;
- Only one person will occupy the MOFB during excavations and/or investigations;
- Exercise care when entering and exiting the MOFB;

- The MOFB will not be used for munitions with a TNT-equivalent NEW exceeding 2.3 pounds.

**Personnel Protective Equipment.** Level “D” PPE will be worn by personnel while using the MOFB. PPE will be in accordance with the SSHP and additional requirements may be directed by appropriate safety authority.

**Inspection.** The MOFB will be inspected for completeness and serviceability prior to and following each use. Missing or unserviceable components will be reported to the SUXOS or the UXOSO for repair or replacement.

**Storage.** The MOFB will be stored as a complete unit with all plates available to facilitate ease of inspection and accountability of components. MOFB should be placed on a wooden pallet or other suitable material. The MOFB should be transported by the most appropriate method available.

**Operations.** USA personnel who employ the MOFB will be trained in its proper use. The MOFB will be used to investigate suspected ordnance items in areas where the observation of the Established Exclusion Zone is not possible.

- Install all required plates prior to investigating and/or excavating the anomaly;
- The MOFB will be placed with the anomaly located a minimum of 6 inches inside the open front;
- The rear of the MOFB will face the area to be protected;
- Use of the MOFB is based on the MGF, the largest being the 155mm;
- Follow all precautions associated with ordnance and explosives;
- Observe safe work practices and procedures.

**“CEASE ALL OPERATIONS IN THE EVENT OF ENTRY BY UNAUTHORIZED PERSONNEL INSIDE THE EXCLUSION ZONE. DO NOT RESUME OPERATIONS UNTIL SITUATION HAS BEEN CORRECTED.”**

**Summary.** This SOP will be followed by those personnel whose duties include the use of the MOFB. This SOP establishes guidance and procedures to minimize the potential hazards associated with the investigation and/or excavations of suspected ordnance items. Personnel will adhere to the use of Safe Work Practices and Procedures during operations.

### 3.9.9 ORDNANCE AND EXPLOSIVES REMOVAL

If the excavated material is considered to be OE it shall be uncovered sufficiently to obtain a positive identification of the item. If the item is identified as OE, a determination will subsequently be made as to whether it is fuzed or not.

It is preferred that unfuzed OE be Blown-in-Place but can be consolidated with other items located or also if the item is located within a sensitive area. A separate determination on disposal will be made by the SUXOS with concurrence of the USACE OE Safety Specialist.

Fuzed UXO must not be moved unless special approval is granted by the USACE OE Safety Specialist and the USAESCH Chief of Safety. The SUXOS will make a determination in each case on how best to dispose of the UXO. If the UXO cannot be safely disposed of under the existing conditions, the USACE OE Safety Specialist will be notified. In no case shall the SUXOS authorize or undertake destruction of UXO when there is sufficient reason to believe that the disposal action will result in personnel casualties or property damage.

A detailed account of all OE and non-OE materials encountered during the surface and subsurface searches will be maintained. A log entry of all OE related materials located in a grid will be made in the database indicating amount, identification, condition, depth, and disposition. A log entry will be made for non-OE materials, indicating the general types of materials encountered and pounds excavated.

USA will not remove scrap small arms cartridge cases during any excavation. Inert OE related scrap and non-OE scrap may be stored in the same general area in separate, lockable (sealed) containers but not commingled. Certification by the UXOQCS and SUXOS that the OE related materials are inert and free of energetic material will be made on DD Form 1348-1A.

All excavations will be filled in and tamped to the approximate consistency of the surrounding soil. The excavation site shall be returned as nearly as feasible to an undisturbed condition.

#### 3.9.10 ORDNANCE AND EXPLOSIVES STORAGE

This subchapter details the procedures to manage the explosives for this project in accordance with the following policies and Federal, state, and local laws and regulations:

- Bureau of Alcohol, Tobacco, and Firearms (ATF) Publication 5400.7 (ATF - Explosives Law and Regulations)
- DoD 6055.9-STD (DoD Ammunition and Explosives Safety Standards)
- Department of Transportation (DOT) Regulations
- Army Regulation 190-11 (Physical Security of Arms, Ammunition, and Explosives)
- Federal Acquisition Regulations (FAR) 45.5
- Local and state laws and regulations

##### 3.9.10.1 Licenses/Permits

USA will maintain a copy of the following documents on-site. Both documents will be made available, upon request, to any authorized Federal, state, or local authority.

- ATF User of High Explosives license;
- A letter signed by an official of USA designating the SUXOS as authorized to purchase, receive, access, and use explosives.

##### 3.9.10.2 Explosives Storage Magazines

USA will not establish on-site storage magazines during field operations. USA plans on a delivery of explosives on the day of disposal and will

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immediately use the material. Section 3.10 details security procedures in the event of delays in explosives delivery.

#### 3.9.10.3 Acquisition of Explosives

Receipt - The SUXOS will be in charge of the demolition operation. The SUXOS will inventory, initiate, and maintain all documentation concerning the demolition material upon receipt from the explosives vendor. The SUXOS, by signing the receipt documents, will assume accountability for the material. Since explosives will not be stored on site, a Magazine Data Card will not be necessary. Section 3.10 details procedures for securing explosives during non-work hours. Quantities will be accounted for on the Explosive Usage Record.

Reconciling Discrepancies - The SUXOS will conduct a 100% inventory of the incoming explosives. USA personnel will only sign for the actual quantity of material received, from the explosive vendor. Actual quantities must be properly annotated on the shipping documentation prior to USA accepting delivery. These procedures will be conducted for each receipt of explosive materials.

#### 3.9.10.4 Disbursement of Explosives

The SUXOS will issue explosives to members of the Demolition Team with the Explosives Usage Record. These forms will be maintained in the site office. The Demolition Team will consist of 1 UXO Technician III and an appropriate number of UXO Technicians II, based on the size and complexity of the demolition operation to be performed.

The Demolition Supervisor receiving the explosives from the SUXOS will conduct a 100 percent inventory of the material. The quantities annotated on the Explosives Usage Record will match the quantities reflected in the inventory. If these quantities do not match, the Demolition Supervisor will bring this to the attention of the SUXOS. The USA Demolition Supervisor will only sign for the actual quantity of material received from the SUXOS, as reflected by the inventory. Receipt documentation will be changed to reflect the proper quantities. These procedures will be conducted for each receipt of explosive materials.

As explosive materials are expended, the SUXOS will annotate the daily journal to reflect the quantity used.

#### 3.9.10.5 Certification of Use of Explosives

The Explosives Usage Record certifies that the explosives were expended, as intended, in the UXO disposal process.

USA will not store any explosive material or OE items except for OE related scrap on site.

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### 3.9.11 ORDNANCE AND EXPLOSIVES DISPOSAL

#### 3.9.11.1 General Procedures

All OE-related material containing explosives will be disposed of by detonation utilizing the standard demolition procedures outlined in Technical Manual (TM) 60A-1-1-31. The Demolition Supervisor has the option of utilizing electric or non-electric firing procedures as the particular situation dictates. The following paragraphs describe the procedures that UXO personnel will use to dispose of OE-related items at the project site.

#### 3.9.11.2 Unexploded Ordnance

USA UXO personnel will dispose of OE/UXO daily when practical and safe to do so. All OE must be disposed of on the day it is located unless unforeseen events preclude its disposal. In the event that this occurs, the USA Site Manager and SUXOS will make arrangements to secure the item during non-work hours. Demolition operations will not begin until all nonessential personnel are outside the MSD of the ordnance being detonated. OE that is acceptable to move may be consolidated to reduce the number of shots. To the greatest extent possible, all items will be Blown-in-Place to reduce the risk inherent in handling and movement of OE.

The USA Site Manager and SUXOS will be on site at all times during disposal operations. These operations will be performed under the direction and supervision of the SUXOS, who is responsible for ensuring that procedures contained in this operations plan and referenced documents are followed. The UXOSO will monitor compliance with the safety measures contained in the SSHP (Appendix D) and associated documents. In the event of noncompliance, the UXOSO is authorized to stop or suspend operations. Disposal activities are inherently hazardous and require strict adherence to approved safety and operational procedures. Violations of procedures may result in immediate removal from this project.

Prior to the start of disposal activities, the UXOSO will verify that the area around the operating site is clear of all nonessential personnel and that other UXO Supervisors have been notified. MSDs will be established and maintained in the vicinity of the operating site based on the maximum fragmentation range of the largest OE known to have been used in this particular sector. When conducting intrusive investigations near residences, the MSD for the appropriate sector will be used. Depending on the type of munitions being destroyed, the MSD may be decreased based on the fragment calculation found in Appendix G of this addendum. Personnel remaining on site will be limited to those needed to safely and efficiently prepare the item(s) for destruction. Engineering controls for blast and fragment mitigation may be necessary for disposal of OE items in close proximity to buildings, structures, roads, etc., to reduce MSD requirements.

**USA OE Disposal Team.** At a minimum, the OE disposal team will consist of the SUXOS and/or the UXOSO, a UXO Supervisor and UXO Specialist. The SUXOS will appoint an experienced and trained UXO Supervisor to be the Demolition Supervisor.

**Evacuation and Site Control.** Prior to initiation of demolition operations, all personnel will be evacuated outside the MSD of the OE being detonated. Prior to priming the demolition charges, all avenues of ingress will be

physically blocked by UXO personnel. Radio communications will be maintained among all concerned parties. Avenues of ingress will not be opened without the express permission of the UXOSO. A constant state of vigilance must be maintained by all personnel to detect any intrusion within the MSD.

**Explosives Storage and Accountability.** The UXO subcontractor will obtain, store, and provide internal accountability for all explosives utilized for the disposal of OE discovered on site in accordance with the Explosive Management Plan (Chapter 5).

**Ordnance and Explosives Disposal Shots.** While preparing OE for detonation, the SUXOS and the UXOSO will ensure that the number of personnel on site is kept to the minimum required to safely accomplish the disposal mission. Authority to initiate demolition operations will rest solely with the SUXOS. Prior to authorizing the detonation of explosive charges, the SUXOS will ensure that (1) all personnel have been evacuated beyond the MSD, (2) all personnel have been accounted for, (3) all pertinent parties have been notified of an impending demolition shot, and (4) the area is secure. Prior to priming demolition shots, the Demolition Supervisor will direct all nonessential personnel to withdraw outside the MSD. Upon priming demolition shots and prior to detonating demolition shots, all remaining personnel will withdraw outside the MSD.

Upon completion of disposal operations, the Demolition Supervisor and another UXO Specialist will visually inspect each disposal site for signs of fire or smoke caused by detonation. If fire or smoke is visible in the disposal site area, the UXO Supervisor will direct emergency procedures to extinguish fires and notify the SUXOS/Site Manager for assistance, if needed. Caution must be taken to ensure burning explosives or OE are not present. If these are present, the demolition team will exit the site and call for assistance. Upon completion of this inspection, and assuming there are no residual hazards, the SUXOS will authorize the resumption of site operations.

The USA SUXOS is responsible for ensuring the completeness of demolition operations and for weekly inspection of the Ordnance Accountability Log, the Daily Operational Log, the Demolition Shot Record, and the inventory of OE and demolition material. The USA SUXOS, assisted by demolition team personnel, will inspect each demolition pit and an area up to 250 feet in radius after each demolition shot to ensure there are no kickouts, hazardous OE components, or other hazardous items. In addition, the pit will be checked with a metal detector (with detection capabilities demonstrated at the geophysical test plot) and any hazardous debris will be removed. Any OE discovered during the post-shot check will be secured and disposed of as soon as this can be safely accomplished. Extreme caution must be exercised when handling OE that has been exposed to the forces of detonation.

**Fire Safety during Disposal Operations.** The USA Site Manager and SUXOS will notify the local fire department of the location and approximate times prior to detonation.

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### 3.9.11.3 Ordnance Scrap

Within or adjacent to each sampling lane or grid, the USA SUXOS will establish temporary, nonhazardous OE scrap collection points. During operations, ordnance-related scrap that is free of explosive contamination will be placed at these collection points. Upon completion of operations in that sampling lane or grid, the material in these temporary collection points will be transported to a predesignated central scrap collection point. Prior to storage of the OE scrap in the central scrap collection point, the SUXOS will perform a second inspection of the material to ensure that it is free of explosives and other hazardous materials. All inert/empty OE items shall be vented. The first inspection of the scrap will be by the investigating team UXO Supervisor, the second by the SUXOS.

The SUXOS shall perform a final inspection of the scrap at the central collection point and certify it to be free of any explosive hazard. The SUXOS shall sign a letter or DD Form 1348-1 (Release/Receipt Document) annotated with the following statement: "This certifies and verifies that the range residue listed has been 100% inspected, and to the best of our knowledge and belief, is inert and/or free of explosive and related material."

USA, in coordination with USACE, will arrange final disposition of the certified and verified material to an organization that will ensure continued chain of custody and provide documentation stating the materials will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content.

### 3.9.12 DISPOSAL ALTERNATIVES

USA will utilize Non-EI (Shock Tube) disposal procedures for the disposal of conventional UXO/OE. Non-EI procedures are the preferred disposal methodology, however, should unforeseen circumstances result in an alternative disposal procedure being necessary to continue operations at the former Waikoloa Maneuver Area, this alternate procedure will be addressed through and approved by USACE personnel prior to implementation.

In areas where an acceptable fragmentation distance cannot be achieved, items acceptable to move may be moved to another area, with the concurrence of the USACE OE Safety Specialist, as long as the movement does not require transportation on public roads. If movement to another area is not possible, other methods of mitigation, such as berms, tamping, or sandbag barricades (in accordance with HNC-ED-CS-S-98-7), will be employed to reduce the fragmentation hazard. If these methods of disposal are determined to be impractical, USA will consult with USAESCH for guidance.

## 3.10 SITE SECURITY PLAN

Work site security is the responsibility of all personnel working on site. USA will be alert to unauthorized personnel entering the work site and will direct these personnel to the USA Field Office. USA will provide visitor safety briefings and UXO qualified escorts to authorized visitors entering work areas.

Since there are limited man-made structures to prevent public access into work areas, USA personnel will patrol the exclusion zone during intrusive investigation and demolition operations. During demolition operations, USA will limit access into the exclusion zone to essential personnel and the USACE Honolulu District Safety Specialist.

To the greatest extent practicable, USA will perform same-day detonation of discovered OE items to minimize personnel and potential public exposure to explosive hazards. In the event OE cannot be destroyed on the same day, USA will provide a UXO Technician III to secure and guard the item during non-work hours.

To prevent tampering and theft of project equipment and scrap material collected during field investigations, USA will store these items in a lockable storage shelter. USA will lock this storage shelter during non-work hours.

### **3.11 INVESTIGATION DERIVED WASTE PLAN**

Previous investigations and records detailing historical use of the maneuver area have not identified Recovered Chemical Warfare Materiel (RCWM) or any other hazardous material contamination at the project site. As a result, the project team does not anticipate recovery, handling, or disposal of Investigative Derived Waste (IDW) during the course of the EE/CA investigations.

### **3.12 DEMOBILIZATION**

After completion of all field activities, USA will shut down site operations from the area and reallocate personnel and equipment to other projects. USA will closely monitor all activities throughout the field effort. When a clear projection can be made of the actual completion date, USA will notify subcontractor personnel regarding the start of personnel and equipment demobilization. Demobilization is anticipated to take 3 working days.

Demobilization activities will include, but not be limited to:

- Removal of all personnel and equipment from the project area (including the field office)
- Close-out of files and records
- Clean up of the field office
- Return of all government-furnished equipment
- Notification of all appropriate points of contact and support organizations of departure
- Close-out of accounts with local vendors.

### **3.13 RISK CHARACTERIZATION AND ANALYSIS**

For the risk characterization and analysis assessment element of this OE EE/CA, the TPP team adopted the OERIA. The OERIA is a stakeholder-friendly method of risk assessment that uses direct analysis of site conditions and human issues to determine potential OE risks at the project site. In contrast to statistically based risk assessment and analysis techniques that have often caused difficulty in stakeholder communications concerning risk, the OERIA provides a qualitative risk assessment that allows more effective, clear risk communication among all stakeholders.

The OERIA evaluates the level of risk to the public in terms of the likelihood of exposure and the severity of exposure to OE. It is important to note that exposure to OE does not indicate that an incident or injury will occur. A person would have to disturb the OE item (e.g., digging for the item, picking it up, or striking it) to be exposed to actual risk.

The three steps in the OERIA process are listed below and described in greater detail in the following sections:

1. Definition of Risk Factors

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2. OE Risk Assessment
  3. Assessment of Response Alternatives

#### 3.13.1 DEFINITION OF RISK FACTORS

The potential risk posed by OE at a site may be characterized by evaluating the likelihood of exposure to OE, the severity of the exposure, and the likelihood of detonation. These three components can be evaluated using the following basic risk factor categories.

1. OE Factors. This category covers the physical characteristics (OE Type, OE Sensitivity) and location/extent (OE Potential, OE Depth Range) of OE at a given site.
2. Site Characteristics Factors. This category refers to the physical conditions of the site and natural events that may occur at the site (Site Accessibility, Site Stability).
3. Human Factors. This category refers to the types of activities (Site Activities) that exist on the site, the number of people (Site Population) that may have access, and the frequency of the access to the site on a daily basis.

For example, the likelihood of exposure may be evaluated by considering the OE potential (based on results of the EE/CA field investigation), the number of people using the site, the type of activities conducted at the site, and the accessibility of the site. Similarly, the type of OE and its sensitivity must be considered to evaluate the likelihood of detonation and severity of exposure. These risk factors are described in the following sections.

#### 3.13.2 ORDNANCE AND EXPLOSIVES RISK ASSESSMENT

The OE Risk Assessment is the second step in the OERIA process. The project team will perform this baseline risk assessment by evaluating the basic risks factors for each OERIA evaluation areas. This risk evaluation uses data collected from the EE/CA investigation, data from previous investigations, documented reports of discovered OE, current and future land uses and the basic risk factors to assess the overall OE hazard level in each of the four OERIA evaluation areas.

#### 3.13.3 ASSESSMENT OF RESPONSE ALTERNATIVES

The third and final step of the OERIA process is the assessment of response alternatives. After completing the baseline risk assessment, the response action alternatives are assessed using the basic risk factors and baseline risk assessment data for each of the four OERIA evaluations areas.

The response action alternatives are analyzed and ranked using each risk factor identified in the baseline risk assessment. Each response action alternative is assigned an impact evaluation score of 'No Impact' or an alphabetical rank from 'A' to 'D' representing the relative impact of the response action alternative – with 'A' being the highest impact and 'D' being the lowest. This comparison provides a qualitative indication of the change in the potential for harm and level of protectiveness at the site for each response action alternative that could be implemented.

The project team will assign an overall alphabetical rank to each response action alternative based upon the impact ranks for each factor. The response action alternative that provides the greatest impact on risk from OE (i.e., achieves the most reduction of the risks posed by the site) is assigned an 'A'.

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The OERIA results are further applied to the evaluation of removal alternatives for the project and serve as an input to the evaluation of the Effectiveness Criteria for Alternatives Evaluation in the EE/CA process.

### 3.14 ANALYSIS OF INSTITUTIONAL CONTROLS

USA will conduct an Institutional Analysis in accordance with EP 111-1-24 as part of the Phase III EE/CA of the former Waikoloa Maneuver Area. As Institutional Controls rely on existing powers and authorities of various government agencies to protect the public at large from OE risks, USA will identify government agencies having jurisdiction over properties containing OE and assess their appropriateness, capability, and willingness to assert this control.

For each institution selected for review, USA will collect the following information:

- Name of Agency
- Origin of Institution
- Basis of Authority
- Sunset Provisions
- Geographic Jurisdiction
- Public Safety Function
- Land Use Control Function
- Financial Capability
- Desire to participate in the Institutional Control Program.
- Constraints to Institutional Effectiveness.

USA will prepare an Institutional Analysis Report to document feasible local initiatives that will be used to support development of alternative plans of action. The report will identify and analyze the institutional framework that supports the development of institutional controls for the former Waikoloa Maneuver Area Phase III EE/CA sectors. The report will address local initiative strategies available to control or limit access to different areas within the project site and/or strategies to implement public safety awareness actions regarding the former maneuver area. The Institutional Analysis will include discussions with state and local agencies, as well as with private parties having interests in the sites.

Following the Institutional Analysis and preparation of the Institutional Analysis Report, USA will prepare a draft Institutional Control Plan for inclusion of in the draft Phase III EE/CA Report details the Institutional Control Alternatives recommended for each Phase III EE/CA sector, based on their apparent ability to satisfy project objectives.

### 3.15 RECURRING REVIEW

The purpose of Recurring Reviews is to determine if a response action continues to minimize explosives safety risks and continues to be protective of human health, safety, and the environment. Recurring Reviews also provide an opportunity to assess the applicability of new technology for technical impracticability determinations that were made prior to implementation of the selected response action. CERCLA requires the review of response actions no less often than every five years to assure that human health and the environment are being protected. The NCP provides that, if a response action is selected that results in residual risk remaining at the site, the lead agency shall review such action no less often than

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every five years after the initiation of the selected response action. The review cycle for OE response actions may be more frequent than every five years, depending on site-specific conditions and design criteria. USA will develop the Recurring Review Plan, as a draft plan, for inclusion into the Phase III EE/CA Report. The draft Recurring Review Plan may require modification during the removal design and post removal action phases before finalization.

Generally, the USACE Honolulu District will maintain responsibility for the residual risk at the site following implementation of the recommended OE response actions by performing recurring reviews. The recurring reviews involve returning to the site 5 years after the recommended OE response actions have been initiated to assess their effectiveness and reliability. After the initial review has been conducted, recurring reviews will be performed at 5-year intervals. The need for recurring reviews will be coordinated with regulators and stakeholders and justified in each recurring review report.

During the recurring review, the USACE Honolulu District will assess the continued effectiveness and reliability of the implemented OE response actions includes by:

- Evaluating if changes have occurred in current and/or future land uses and their effect, if any, on selected OE response actions
- Investigating reported OE encounters that may have occurred since completion of the OE response actions
- Conducting interviews with local agencies regarding the effectiveness of community awareness outreach programs and educational media
- Conducting visual spot inspections on the former maneuver area to evaluate erosion effects (e.g., storms, wind, fires, vegetation loss), display case condition, and the status of supplies and effectiveness of community awareness outreach programs and educational media.

The USACE Honolulu District will implement these recurring reviews and fund the maintenance, repair, and/or replacement of the implemented institutional controls (i.e., display cases, warning signs, informational pamphlets, notification letters, and OE safety awareness training video). Long-term implementation of institutional controls (with the exception of construction support) will be the responsibility of landowners and local agencies.



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## 4. QUALITY CONTROL PLAN

### 4.1 INTRODUCTION

The USA QC process starts with top management commitment and involvement. The process provides a permanent and workable system that allows each employee to understand the job performance expected. The USA QC and improvement process ensures that the actions, procedures, tools support every employee and training required to do a job according to the requirements. By promoting teamwork and by focusing attention on the solutions, the quality of work can be increased and assured throughout the project.

This QC Plan provides the procedures and methods that will be used at the former Waikoloa Maneuver Area project site. This plan addresses organization and responsibilities, equipment testing, function checks, and calibration, QC inspections and audits, and reporting procedures.

### 4.2 QUALITY MANAGEMENT STRUCTURE

The following paragraphs describe the organizational structure of the USA Quality Management Team for during operations at the former Waikoloa Maneuver Area project site.

#### 4.2.1 CORPORATE QUALITY CONTROL MANAGER

The USA Quality Control (QC) Manager has responsibility for the USA QC program. The QC Manager reports directly to the Vice President of USA on matters of effectiveness, adequacy, and status of QC methods and procedures. He maintains an alternate line of communication to the President of USA. The QC Manager has the following responsibilities:

- Preparation of USA QC policies and procedures;
- Ensuring timely submission of contract deliverables;
- Providing training and assistance to the UXOQCS;
- Reviewing employee qualification records to ensure accuracy;
- Conducting periodic field audits of sites, programs, and projects to ensure QC compliance.

#### 4.2.2 CORPORATE PROJECT MANAGER

The USA Project Manager is responsible for the overall performance during this project. The Project Manager will develop and implement the site Work Plan. The USA Project Manager has the following responsibilities:

- Monitoring project cost and performance;
- Ensuring timely submission of contract deliverables;
- Reporting directly to the USA Program Manager.

#### 4.2.3 SITE PROJECT MANAGER

The Site Manager is responsible for the day-to-day operations at the project site. The Site Manager reports directly to the USA Project Manager. The Site Manager has the following responsibilities:

- Implementation of the USA Work Plan and QC policies and procedures;

- Reporting to the USA Project Manager on effectiveness, adequacy, and status of the project;
- Ensuring the timely submission of contract deliverables;
- Analyzing any failures and implementing corrective actions;
- Establishing additional guidelines to assist in the development of site and task specific policies and procedures.

#### 4.2.4 UNEXPLODED ORDNANCE QUALITY CONTROL SPECIALIST

The UXOQCS is responsible for the enforcement of the site QC plan. The UXOQCS coordinates with the Site Manager for daily operations and maintains a direct line of communication to the USA QC Manager. The UXOQCS reports directly to the QC Manager and has the following responsibilities:

- Reviewing, implementing, and enforcing the QC plan;
- Coordinating with the USACE QA representative to ensure QC objectives are appropriate for the task being performed;
- Conducting QC inspections and audits of documents, work in progress, work performed, and monitoring.
- Recording and reporting the results to the appropriate personnel;
- Recommending to the Site Manager any actions to be taken in the event of a QC failure;
- Advising the Site Manager on all QC related site matters;
- Reporting non-compliance with QC criteria to the Site Manager and the USA QC Manager;
- Has **STOP WORK** authority for issues regarding QC at the project site.

### 4.3 QUALIFICATIONS AND TRAINING

#### 4.3.1 EMPLOYEE QUALIFICATIONS

The Site Manager will maintain personnel files on each employee at the project site. These files include copies of necessary license, training records, certificates of qualifications, and resumes that support the employee's placement and position. Prior to an employee's initial assignment or before any change in duties or assignment the UXOQCS will review the employee's file to ensure necessary qualifications are met. Site personnel must meet the qualifications as outlined in DID OE-025.01.

#### 4.3.2 EMPLOYEE TRAINING

USA ensures that only qualified and trained personnel are assigned to project sites. Prior to mobilization of personnel, USA ensures that training required by USA and OSHA 29 CFR 1910.120 has been completed for all personnel assigned to the project. In addition, prior to the start of operations all personnel will receive the following:

- Familiarization with the Work Plan, and its policies and procedures;
- SSHP orientation and PPE training;
- Environmental considerations peculiar to the operations on the project site;

- Instruction and training on equipment usage and safe work practices;
- Daily safety training outlining the day's activities.
- Training is conducted by the UXOSO and records of attendance are maintained on site. Certificates of Training are issued when applicable.

#### 4.4 EQUIPMENT TESTS, FUNCTIONAL CHECKS, CALIBRATION, AND MAINTENANCE

##### 4.4.1 TESTING PROCEDURES AND FREQUENCY

Instruments and equipment, such as geophysical/navigational, and data analysis and transfer systems, used to gather and generate site characterization data will be tested with sufficient frequency and in such a manner as to ensure that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

The method performed for measuring the instrument response will be conducted at the start of each workday, over a test area, and comparing that response and position to a known response and position recorded prior to the instrument being placed into service. Instruments or equipment failing to meet the standard will be repaired, recalibrated, or replaced. Replaced instruments or equipment must meet the same specifications for accuracy and precision as the item removed from service.

Items such as cellular telephones and radios will be tested for serviceability at the start of each workday. Results of these tests will be recorded in the Daily Journal. Items failing these tests will be repaired or replaced prior to operations commencing.

##### 4.4.2 GEOPHYSICAL PROVE-OUT/INVESTIGATION TEST-PLOT

USA established a GPO of sufficient size and containing an appropriate number of inert target and clutter items. The seed items in the land GPO range in size, depth, and composition as are expected to be found on the project. A local investigation test plot (ITP) will also be established adjacent to survey areas distant from the land GPO. Seed items for the ITP will be free of hazardous/energetic materials. Seed items will be recorded by a uniquely identified number, X, Y, and Z location, and the inclination/declination for each item. Each seed item and the end stakes of each ITP will be surveyed to the nearest 0.1 foot.

##### 4.4.3 ROUTINE EQUIPMENT CHECKS

A six-line standardization file will be acquired the first day on-site with the equipment selected for digital geophysical surveying. The six-line test will be acquired over a background line at least 15-feet long. Lines 1 and 2 are background lines acquired at normal survey speed in opposite directions. Lines 3 and 4 are acquired at normal survey speed in opposite directions with a known target (e.g. 2-inch tow ball) placed along the line. Line 5 is a repeat of Line 3 at a slower than normal survey speed. Line 6 is a repeat of Line 4 at a faster than normal survey speed. This file is used to document system latency (the time lag between sensor and position data reporting as a function of survey direction and speed) that is used in processing and correctly positioning survey data.

Digital geophysical instruments and RTK DGPS positioning equipment will be checked daily. The RTK-DGPS will be checked above a known coordinate, a variance of +/- 10 cm is acceptable, deviations above 10 cm will be cause for examination of the DGPS setup prior to commencing operations. A local static background and standard anomaly response file will be acquired at the beginning and end of each grid/transect survey. This file will be used to document system noise levels (including

ambient noise conditions), standard response values, and any sensor drift for each survey area. A test line/lane through the GPO plot or a local ITP with a known, common (e.g. the same) target will be performed at the beginning and end of each survey day. This file will be compared to an original GPO survey line to exercise file transfer, data processing, and analysis, and assure consistent detection thresholds and positioning accuracy.

Excessive noise levels greater than typical background response will result in operator cleanliness checks, i.e., no metal on operator's body or clothing, cabling checks and a repeat of the static test. Standard response values that differ by more than 20% from baseline tests will result in sensor repair, or replacement and a repeat of the system check. Sensor drift in excess of +/- 2.5 mV or gammas will require a change in system batteries or battery recharge and retest. Failure to meet the system drift requirement will require equipment repair or replacement and retesting. Positional errors greater than +/- 1.2 feet will require an explanation (satellite planning software check if DGPS is in use), reprocessing, and analysis, and resurvey if deemed necessary.

The Whites Spectrum XLT metal detector will be tested each workday prior to being placed into service. This test will include a functions check (described below) and the locating of selected, known anomalies within the GPO Test Plot or ITP. Selected anomalies will be seed items that meet the size and depth requirements necessary to determine the serviceability of the instrument. Instruments failing this test will not be placed into service and will be repaired or replaced as directed by the SUXOS or UXOQCS.

A Spectrum XLT functions check will be accomplished by moving the on/off/volume/range selector switches through their various positions and determining their serviceability/functionality.

#### 4.4.4 CALIBRATION

Instruments and equipment requiring calibration or recalibration will have this accomplished in accordance with the manufacture's recommendation or owner's manual. Calibrations will be completed on a prescribed schedule and the calibration results recorded in the daily field logbook. Recalibration will be performed as necessary with the reason for the recalibration and the results recorded in the daily field logbook.

#### 4.4.5 MAINTENANCE

Scheduled maintenance will be performed in accordance with the manufactures/owners recommendation or owners manual for equipment requiring regular upkeep. This equipment includes but is not limited to:

- Vehicles;
- Powered Equipment;
- Personal Protective Equipment;
- Communications Equipment;
- Geophysical and Navigational Equipment;
- Handheld Metal Detector;
- Emergency Equipment;

- 
- Boat and Motor.
  - Repair or replacement parts will meet the manufacture's requirements/recommendations and be installed by personnel authorized to replace parts or make repairs. Records pertaining to the testing, repair, and/or replacement of instruments and equipment will be maintained on site by the UXOQCS.

#### 4.5 ACCURACY

Coordinate information for transects/grid locations will be verified and geometric accuracy of the geographic features will be checked. A detected error will result in the data being examined and the correct location and place points will then be determined in the project GIS data set to represent identifiable elements of the feature (i.e. corners or intersections). A local grid system may be used on the former Waikoloa Maneuver Area project site. The RTK DGPS will be checked above a known coordinate, a variance of +/- 10 cm is acceptable, and deviations above 10 cm will be cause for examination of the DGPS setup prior to commencing operations. All water surveys, using the RTK-DGPS for sensor positioning, will utilize satellite planning software to schedule survey operations during times of peak predicted GPS performance. Specific criteria include 5 or more satellites available above the minimum elevation mask (e.g. 15 degrees above the horizon) and a PDOP value of 6.0 or less (a GPS quality of position metric).

GIS coverage should be evaluated to determine if the geographic features are correct. Errors found will be corrected and noted in the operations field logbook. The accuracy of transects/grid corners will be to the closest 1.0 foot.

#### 4.6 QUALITY CONTROL

##### 4.6.1 HANDHELD EM CHECK

A QC check of selected investigated anomalies will be performed to determine that the intended anomaly has been removed. Excavations of any un-dug anomalies discovered during the QC survey will be thoroughly investigated and the results recorded.

##### 4.6.2 DIGITAL GEOPHYSICAL MAPPING FAILURE CRITERIA

The following summarize the DGM pass/fail criteria:

- Instrument Latency will be corrected using an appropriate correction routine that accounts for instrument latency time and sensor velocity (see description of the six-line test in Section 4.4.3). Corrections will be specific for all segments of data with equal sensor velocities. The acceptance/failure criteria for latency corrections are No "zig-zag" or "chevron" effects are visible in the data maps when plotted at the scales used to detect the smallest amplitude signal for any given UXO item expected at this site.
- Instrument Noise will be less than +/- 5 mV for time gate 1, +/- 3 mV for time gate 2, and +/- 2.5 mV for time gates 3 and 4 after correction.
- Instrument response to a standard (e.g. the same) target will not deviate by more than 20% from day to day.
- If used, gradiometric magnetometer data will be corrected for heading errors such that there is no visible heading affects in the data displayed at the amplitude range used for detection and analysis. If used, magnetometers will be deployed in a vertical gradiometer configuration only. This eliminates the need for a base station and helps reduce noise detected on both sensors.

- All leveling and/or filtering routines that are applied to datasets will be evaluated, on a dataset by dataset basis, to confirm that those routines do not adversely alter the nature of the original measured response. All data requiring leveling will be leveled using the same routines and parameters.
- Anomaly Location Accuracy will not exceed +/- 1.0 foot.
- Reoccupation accuracy will not exceed +/- 10 cm (0.33 feet) from the control location.
- Data Sampling Density along-track will not exceed 0.5 feet for EM data.
- The across-track line spacing will not exceed 3 feet.
- False Negatives (e.g. the likelihood that specific individual OE items can not be reliably detected)
- A DGM false negative failure will occur if, during the UXOQC/QA of any transect/grid, an OE item is discovered. A QC/QA discovery of any isolated OE item 37mm or larger or any live OE item found at the depth of concern for that area, but outside the physical area surveyed, will not be a current project QC/QA failure. The senior geophysicist or the interpretive geophysicist will certify that all intrusive dig results have been reviewed by them and that they accept the reported findings as reasonable for the interpreted anomaly signatures. Failures will be documented, reported, and corrective actions taken, to include a re-analysis and re-investigation of that grid/transect.

#### 4.6.3 INTRUSIVE INVESTIGATION FAILURE CRITERIA

A failure will occur if, during the QC/QA of any transect/grid investigation excavation, any live OE item is found or any metal item with dimensions equal to or larger than a 37mm projectile (diameter and length) is discovered. A QC/QA discovery of any isolated OE item 37mm or larger or any live OE item found at the depth of concern for that area, but outside the physical area surveyed, will not be a current project QC/QA failure. This information will be included in the risk analysis for this EE/CA. The senior geophysicist or the interpretive geophysicist will certify that all intrusive dig results have been reviewed by them and that they accept the reported findings as reasonable for the interpreted anomaly signatures. Failures will be documented, reported, and corrective actions taken, to include a re-analysis and re-investigation of that grid/transect.

## 4.7 QUALITY CONTROL INSPECTIONS, AUDITS AND REPORTS

The UXOQCS is responsible for the accomplishment of operational checks of instruments and equipment by site personnel. The appropriate log entries will be made. Inspections and or audits will be performed at random, with unscheduled checks of the site to ensure personnel accomplish all work as specified in the Work Plan. USA UXOQCS will not perform a QC inspection of any grids or transects during the DGM operations. The EE/CA is a characterization of the former Waikoloa Maneuver Area, not a removal and the ability of a QC to perform excavations will be limited due to engineering control requirements. The UXOQCS will submit a report to the Site Manager detailing the results of these checks.

### 4.7.1 CORRECTIVE ACTIONS

Project personnel have a daily responsibility to promptly identify and report problem areas, solicit approved corrective actions, and report any condition adverse to quality. Corrective actions will be documented and verified by follow-up reviews and checks. Corrective actions will be initiated at a minimum when:

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- Predetermined acceptance standards are not attained;
  - Procedures or data compiled are determined to be faulty or contain errors;
  - Equipment or instrumentation is found to be faulty;
  - QC requirements are violated;
  - Results of audits or inspections reveal substandard performance;
  - As directed by management assessment.

#### 4.7.2 NONCONFORMANCE ACTIONS

Any nonconformance to contractual requirements will be documented and reported. Nonconformance includes:

- Delivery of items or services by USA that do not meet the contractual requirements;
- Errors made in following work instructions or improper work instructions;
- Unforeseeable or unplanned circumstances that result in items or services that do not meet quality, contractual, and/or technical requirements;
- Technical modifications to the project by individuals without the authority to do so;
- Errors in craftsmanship and trade skills.

Immediately upon receipt of a notice of nonconformance the Site Manager will take the following corrective actions:

- Identify the impact the nonconformance has on the project or its activities;
- Identify and implement necessary actions required to bring the project or activity back into compliance;
- Identify and implement procedures to preclude a reoccurrence of the nonconformance.

#### 4.7.3 QUALITY ASSURANCE REPORT

The UXOQCS will prepare a weekly QA Report. This report is submitted to the Site Manager for distribution to the appropriate personnel. This report will include:

- The periodic assessment of accuracy, precision, and completeness of work performed;
- Significant QA/QC problems and corrective actions taken;
- Work progress;
- Lessons learned, and change recommendations;

#### 4.7.4 CONTRACTUAL SUBMITTALS

All required submittals will be delivered in accordance with contractual obligations. Submittals will be generated by the responsible office or section and reviewed at the next higher level to ensure they meet contractual requirements. Changes or revisions to existing documents will be conducted in the same manner. Work shall be accomplished in a timely manner, with submittals processed/communicated to the appropriate personnel or agency.

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#### 4.7.5 LOGS AND RECORDS

Activity Logs will be maintained daily as applicable. USA will make all logbook entries in indelible ink. Logbooks will be bound and pages consecutively numbered. Logbooks and records may be supplemented by the use of preprinted forms (i.e. safety inspection forms, tailgate safety briefings, etc). These forms help to ensure uniformity of activities being conducted, inspected, and reviewed. Forms are provided in Appendix J. The following logbooks and records will be maintained on site and are subject to inspection.

##### 4.7.5.1 Daily Journal

The Daily Journal will be maintained by the USA Site Manager, it provides a summary of all operations conducted on site to include:

- Date and recorder of information;
- Start and end time of work activities, including lunch, breaks, and down time;
- Work stoppage;
- Visitors and escorts;
- Weather conditions;
- Changes to the Work Plan, SSHP, policies or procedures;
- Injuries and /or illnesses;
- Safety briefings;
- OE/UXO encountered;
- Relevant events and training;
- Signature of the Site Manager.

##### 4.7.5.2 Logbooks

The Field Logbooks are maintained by the Supervisory Personnel. These logbooks are used to record site activities and field data. Logbooks are maintained in a neat and legible manner and provide an historic record of site activities, to include:

- Date and team location;
- Personnel and work performed;
- Equipment and instrument checks;
- Injuries and/or illnesses;
- Changes to work instructions;
- Work stoppage;
- Visitors;
- Other relevant events;
- Signature of Supervisor.

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#### 4.7.5.3 Safety Logbook

The site UXOSO will maintain the Safety Logbook. This logbook is used to record all safety matters associated with the project site, including:

- Safety briefings and/or meetings;
- Training;
- Safety inspections and audits performed;
- Work stoppage due to safety issues;
- Visitors;
- Accidents, incidents, and near misses with corrective action taken;
- Site control measures;
- Other relevant events;
- Date and teams checked;
- Signature of the UXOSO.

#### 4.7.5.4 Quality Control Logbook

The USA UXOQCS will maintain a QC Logbook to record all QC matters associated with the project site, including:

- Equipment testing and results;
- QC inspections and audits performed;
- Work stoppage due to QC issues;
- Equipment monitoring results;
- Non-conformance reporting;
- Other relevant events;
- Date and teams checked;
- Signature of UXOQCS.

#### 4.7.5.5 Training Records

The Site Manager will maintain training records. These records contain any license, certificates, or other qualifying data, to include:

- Date and nature of training;
- Personnel attending and instructor(s);
- Visitor training and briefings;
- Signature of instructor and Site Manager.

#### 4.7.5.6 OE/UXO and Anomaly Records

The team supervisor prepares individual OE/UXO and Anomaly Records for each operating lane/grid to record data on anomaly excavations and OE/UXO encountered. These records also include:

- Date and lane/grid identifier;

- Type, condition, depth, and location of OE/UXO encountered;
- Disposition of OE/UXO;
- Other relevant data;
- Signature of Supervisor.

#### 4.7.5.7 Photographic Logbook

USA will collect videos and photographs to document OE/UXO encountered and site conditions before, during, and after field work. The Site Manager will maintain a Photographic Logbook to record all video and photographs collected at the project site. Videotapes and photographs will include:

- Date and time taken;
- Unique identifying number(s) relating to the Photographic Logbook;
- Location video or photograph was taken;
- Brief description of the subject matter.

#### 4.7.5.8 Maps

The Site Manager will maintain maps pertaining to the project site. These maps are used to document OE/UXO finds, lane/grid locations, and site boundaries. Maps will include:

- Standard border;
- Revision block;
- Title block;
- Index sheet layout;
- Legend;
- Metric grid lines;
- Lane/Grid tick layout;
- Magnetic north, grid north, and true north arrows;
- Plotted in various sizes according to task and directives.

#### 4.7.5.9 Final Engineering Evaluation/Cost Analysis Report

The Final EE/CA Report shall be generated upon completion of the project in accordance with the requirements outlined in the contract. This report shall include all relevant data, lessons learned, changes to procedures or equipment, or recommendations used to substantiate finding within the report. QC documentation will be incorporated into the final report or submitted as supporting documentation.

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## 5. EXPLOSIVES MANAGEMENT PLAN

### 5.1 PURPOSE

The purpose of this plan is to describe the procedures applicable in the conduct of explosives management on sites contaminated with OE or OE scrap. These responsibilities include acquisition, license/permits, initial receipt, storage, emergency notification, explosive compatibility, inventory, transportation, and audit criteria.

### 5.2 SCOPE

This plan applies to all site personnel, including contractor and subcontractor personnel, involved in the conduct of Explosives Management on a site with OE contamination. This plan is not intended to contain all requirements needed to ensure compliance.

### 5.3 REFERENCES

The following documents were used in preparing this plan.

ATF P 5400.7, ATF-Explosives Law and Regulations

AR 385-64, Ammunition and Explosives Safety Standards

AR 190-11, Physical Security of Arms, Ammunition and Explosives.

USAESCH Safety Concepts and Basic Considerations for UXO

USAESCH Data Item Description OE-005-03.01: Explosives Management Plan

DA PAM 385-64, Ammunition and Explosives Safety Standards

DOD 6055.9-STD, Ammunition and Explosives Safety Standards

DOD 4145.26-M, Contractor's Safety Manual for Ammunition and Explosives

DOT, 49 CFR Parts 100 to 199, Transportation (applicable sections)

OSHA, 29 CFR Part 1910, Occupational Safety and Health Standards

OSHA, 29 CFR Part 1926, Construction Standards

TM 9-1300-2-6, Ammunition and Explosive Standards

TM 9-1300-200, Ammunition General.

### 5.4 RESPONSIBILITIES

The Project Manager, in conjunction with the SUXOS, is responsible for the initial quantity and type of demolition material ordered. The SUXOS will be responsible for all subsequent requisitions for demolition materials. This will be accomplished by submitting a requisition through the Project Manager, who approves it and forwards it to the Contracting Officer for the preparation of a requisition. The Contracting Officer then forwards the requisition to the Contracting Administrator for action.

### 5.5 ACQUISITION

Explosives will be procured from a commercial supplier on an as-needed basis; no storage of explosives at the project site is anticipated. The requisition of explosives will be in accordance with UXO subcontractor policies. Generally, response time to requisitions is better for those suppliers closest to the site.

## 5.6 LICENSE AND PERMITS

USA maintains a valid ATF license/permit on hand, to include an Explosives Purchase/Receipt Authorization List for the receipt of explosives (Figure 5-1 and Figure 5-2). These documents are on file at USA corporate office, and a copy will be provided to the explosives supplier prior to the purchase of explosives. A copy of all required licenses/permits and an authorization list for the project site will be maintained at the site field office.

## 5.7 STATE BLASTERS LICENSE/STATE OR COUNTY PERMITS

At least one of the UXO technicians on site will possess a current, valid blaster's license from the State of Hawaii. It may also be necessary to obtain a state or county permit to conduct demolition operations. This process is accomplished by contacting the State Fire Marshall and/or County Fire Department for permit applications.

## 5.8 INITIAL RECEIPT

Only those individuals named on the authorization list may sign for explosives received from the shipper. In order to ensure the quantity shipped is the same as the quantity listed on the shipping documents, two UXO personnel will inventory the shipment prior to signing for any demolition materials.

### 5.8.1 RECEIPT PROCEDURES

Explosives shipments generally are accompanied by the explosives supplier's bill of lading and the freight companies' shipping document. The initial inventory will include reconciling the two documents with the actual shipment received (Figure 5-3 and Figure 5-4).

Regardless of the outcome of the initial inventory, one copy of the bill of lading and the freight company shipping document will be attached to a copy of the purchase order request and the purchase order. One copy of each of these four documents will be kept on file at the site field office, and one complete copy should be forwarded to the USA Project Manager located in the Tampa, Florida office.

### 5.8.2 EXPLOSIVES RECEIPT DISCREPANCY

In the event that there is a discrepancy between the amount of explosives shipped and the amount received, the SUXOS will immediately contact the explosives supplier and explain the discrepancy. It is the responsibility of the supplier and shipper to rectify the situation. The supplier and/or shipper must then correct their documents and forward same to the site.

## 5.9 STORAGE

In the event that explosives are required for the disposal, or venting of UXO/OE items, the proper amount of explosives for one day usage will be order using one day delivery service. Explosives will be stored in an approved day box. Explosive detonators will be stored in the IME 22 container. At no time will the day box or IME 22 container be left unaccompanied.

### 5.9.1 ISSUE/RETURN OF EXPLOSIVE MATERIAL

Following each issuance or receipt of explosive material to authorized personnel, the UXOQCS will conduct a joint inventory in conjunction with the Demolition Supervisor when issued explosives. In the event that not all the explosives are consumed due to unforeseen events the Demolition Supervisor will notify the SUXOS. The SUXOS will

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coordinate the return of the explosives back to the original supplier. Prior to turnover of the explosives to the supplier an inventory will be conducted.

#### 5.9.2 LOST/STOLEN OR UNAUTHORIZED USE OF EXPLOSIVES

In the event that there is a discrepancy during any inventory, the item will be re-counted a minimum of two additional times. If the discrepancy is not resolved, the USA Project Manager, UXO subcontractor or Project Manager, USAESCH Safety Representative, and ATF will be notified. ATF will dictate all subsequent actions.

### 5.10 TRANSPORTATION REQUIREMENTS

Transportation of OE and explosives will comply with all Federal, state, and local regulations. No permits are required under CERCLA for on-site transportation of explosives.

Transportation of explosives and OE on the site or on federal installations will comply with the following:

- Vehicles will be inspected using Weekly Vehicle Inspection Checklists and will be properly placarded
- Vehicles will be inspected prior to loading and on-site transportation of explosives using the Explosive Vehicle On-Site Inspection Form provided in Appendix J. Vehicles will be inspected prior to transportation of explosives on public roadways using DD Form 626.
- Explosives will be transported in closed vehicles whenever possible. When using an open vehicle, explosives will be covered with a flame-resistant tarpaulin (except when loading/unloading)
- Vehicle engine will not be running, and wheel chocks and brakes will be set when loading/unloading explosives
- Beds of vehicles will have either a plastic bed liner, dunnage, or sand bags to protect the explosives from contact with the metal bed and fittings
- Vehicles transporting explosives will have a first-aid kit, two 10-pound-rated fire extinguishers, and communications capabilities
- Initiating explosives, such as detonators, will remain separated at all times
- Compatibility requirements will be observed
- Operators transporting explosives will have a valid driver's license
- Drivers will comply with posted speed limits, but will not exceed an acceptable speed for conditions. Vehicles transporting explosives off-road will not exceed 25 miles per hour.

### 5.11 AUDIT CRITERIA

The following items related to explosives acquisition, storage, accountability, and transport will be audited to ensure compliance with this addendum.

- The Demolition Shot Record
- The Site Daily Operational and Safety Logs
- The Safety Training Attendance Forms, for the Initial Site Hazard Training
- The Safety Training Attendance Forms, for the Daily Tailgate Safety Briefings
- The Daily Safety Inspection and Audit Log
- The Explosives and Accountability Log.



DEPARTMENT OF THE TREASURY - BUREAU OF ALCOHOL, TOBACCO AND FIREARMS

**LICENSE/PERMIT (18 U.S.C. CHAPTER 40, EXPLOSIVES)**

In accordance with the provisions of Title XI, Organized Crime Control Act of 1970, and the regulations issued thereunder (27 CFR Part 55), you may engage in the activity specified in this license/permit within the limitations of Chapter 40, Title 18, United States Code and the regulations issued thereunder, until the expiration date shown. See "WARNING" and "NOTICES" on back.

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DIRECT ATF CORRESPONDENCE TO	<b>CHIEF, NATIONAL LICENSING CENTER</b> ATF, P.O. Box 2994 Atlanta, GA 30301-2994	LICENSE/ PERMIT NUMBER	<b>9-HI-003-20-5D-00008</b>
		EXPIRATION DATE	<b>April 1, 2005</b>

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NAME	<b>DONALDSON ENTERPRISES INC</b>	Premises Address <b>45-1055 KAMEHAMEHA HWY #203 KANE OHE, HI 96744-</b>
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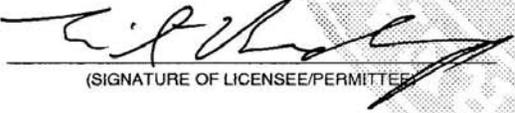
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TYPE OF LICENSE OR PERMIT	<b>20-MANUFACTURER OF HIGH EXPLOSIVES</b>
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CHIEF, NATIONAL LICENSING CENTER	
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<p><b>PURCHASING CERTIFICATION</b></p> <p>I certify that this is a true copy of a license/permit issued to me to engage in the activity specified.</p> <p> (SIGNATURE OF LICENSEE/PERMITTEE)</p> <p>The licensee/permittee named herein shall use a reproduction of this license/permit to assist a transferor of explosives to verify the identity and status of the licensee/permittee as provided in 27 CFR Part 55. The signature on each reproduction must be an ORIGINAL signature.</p>	<p><b>LICENSEE OR PERMITTEE MAILING ADDRESS-</b></p> <p><b>DONALDSON ENTERPRISES INC</b> <b>45-1055 KAMEHAMEHA HWY #203</b> <b>KANE OHE, HI 96744-</b></p>
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ATF F 5400.14/5400.15, Part 1 (8/89)

Figure 5-1. Bureau of Alcohol, Tobacco, and Firearms License



		P.O. BOX 310 LINCOLN, CALIFORNIA 95648 TELEPHONE (916) 645-3377				STRAIGHT BILL OF LADING NON-NEGOTIABLE				
		SOLD TO		SHIP TO						
ORDER NO.	ORDER DATE	CUSTOMER NO.	SALES PERSON	PURCHASE ORDER NO.	SHIP VIA	SHIP DATE	ROUTE			
QTY RETURNED		UNIT	QTY SHIPPED	ITEM NUMBER	HAZARD CLASS	UN NUMBER	PRO GROUP	DOT EXEMPTION	SHIP UNIT	SHIPPED QUANTITY
SAMPLE										
FEDERAL LICENSE NO. 9CA015269H11327 FEDERAL LICENSE NO. 9CA031200806193 S. DOT NO. 118279 AZ. MAT. LIC. NO. HMX 35151			THIS IS TO CERTIFY THAT THE ABOVE NAMED MATERIALS ARE PROPERLY CLASSIFIED, DESCRIBED, PACKAGED, MARKED AND LABELED, AND ARE IN PROPER CONDITION FOR TRANSPORTATION ACCORDING TO THE APPLICABLE REGULATIONS OF THE DEPARTMENT OF TRANSPORTATION.					RECEIVED BY: _____ TITLE: _____ DATE: ____/____/____		
			FOR ALPHA DYNO NOBEL, INC. BY _____							
OFFICE ORIGINAL						<b>Bill of Lading</b>				

Figure 5-3. Sample Explosives Bill of Lading





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## 6. EXPLOSIVES SITING PLAN

### 6.1 PURPOSE

The purpose of this plan is to provide explosives safety criteria for planning and siting explosives during the EE/CA process to be performed at the former Waikoloa Maneuver Area.

### 6.2 SCOPE

This plan applies to all site personnel, including contractor and subcontractor personnel, involved in the conduct of Explosives Siting on a site with OE contamination. This plan is not intended to contain all requirements needed to ensure compliance.

### 6.3 REFERENCES

The following documents were used in preparing this plan.

ATF P 5400.7, ATF-Explosives Law and Regulations

AR 385-64, Ammunition and Explosives Safety Standards

AR 190-11, Physical Security of Arms, Ammunition and Explosives.

USAESCH Safety Concepts and Basic Considerations for UXO

USAESCH Data Item Description OE-005-04.01: Explosives Siting Plan

DA PAM 385-64, Ammunition and Explosives Safety Standards

DOD 6055.9-STD, Ammunition and Explosives Safety Standards

DOD 4145.26-M, Contractor's Safety Manual for Ammunition and Explosives

DOT, 49 CFR Parts 100 to 199, Transportation (applicable sections)

OSHA, 29 CFR Part 1910, Occupational Safety and Health Standards

OSHA, 29 CFR Part 1926, Construction Standards

TM 9-1300-2-6, Ammunition and Explosive Standards

TM 9-1300-200, Ammunition General.

### 6.4 RESPONSIBILITIES

The Project Manager, in conjunction with the SUXOS, is responsible for meeting all the applicable storage requirements for the explosives stored and used on site during the performance of this effort.

### 6.5 QUANTITY DISTANCE

The initial MGF D for Sectors 15, 16, and 17 are provided in Table 6-1. The Quantity-Distance (Q-D) Map for the Phase III EE/CA is provided as Figure B-3 in Appendix B. However, if an OE item with a greater fragmentation distance is found the Q-D arcs will be adjusted and an amendment to the submission will be submitted for approval.

Based on historical evidence, MKII hand grenades were located near Sectors 15 and 155mm projectiles have been located near Sector 16 and Sector 17. Therefore, the maximum fragmentation distance will be based on a MKII hand grenade (Sector 15) and a 155mm projectile (Sector 16 and Sector 17). The maximum fragmentation distances for unrelated personnel using a MKII hand grenade and a 155mm projectile were calculated by USAESCH

Blast Effect personnel and are provided in Appendix G. The UXO team separation distance for surface and subsurface clearance activities are also provided in Appendix G.

## 6.6 PLANNED OR ESTABLISHED DEMOLITION AREAS

There are no planned demolition areas for this project.

## 6.7 FOOTPRINT AREAS

There are three types of footprint areas: Blow-in-Place, OE collection points within a search grid, and consolidated shots within a search grid. USA will utilize the Blow-in-Place method.

## 6.8 BLOW-IN-PLACE

Blow-in-place will be used for OE items unacceptable to move. The demolition locations will be confined to the boundaries of each sub-area. Demolition sites will exist where UXO are found and detonated. The location of UXO, which must be detonated in place, cannot be predicted, and they could occur at any point on the site. All UXO that are detonated in place will be well documented and the position indicated on the site map. Table 6-1 identifies intentional detonation withdrawal distances for all personnel for munitions/explosives expected to be encountered during UXO operations. If an OE not listed in Table 6-1 is encountered, its withdrawal distances shall be determined in accordance with the default distances in DoD 6055-.9-STD.

**Table 6-1. Safe Separation Distance for all Personnel during Intentional Detonations**

Sector	Munition	Maximum Fragmentation Range (ft)	Safe Blast (Over pressure/ K328W <sup>1/3</sup> ) (ft)	Withdrawal Distances for all Personnel (ft)
Sector 15	MKII Hand Grenade	650	174	650
Sector 16	155mm projectile	2,577	922	2,577
Sector 17	155mm projectile	2,577	922	2,577

Note: Safe blast overpressure was calculated using the net explosive weight of the item being destroyed and the donor charge (i.e. shape charge with 38 grams of RDX and 10 feet of 80 grain detonating cord) for a total of 0.198 pounds donor charge.

## 6.9 COLLECTION POINTS

Collection points are areas where recovered OE that is acceptable to move will be temporary accumulated prior to disposal at the end of the workday. The size of the exclusion zone will be established in accordance with the Department of Defense Explosives Safety Board (DDESB) approved method (i.e., Procedures of Demolition of Multiple Rounds).

## 6.10 IN-GRID CONSOLIDATION SHOTS

In-grid consolidation shots are areas within the search grids where OE items acceptable to move are collected and destroyed through explosive detonation. An exclusion zone will be established for each in-grid consolidated shot area. The size of the exclusion zone and the setup of the shot will be accomplished in accordance with the DDESB approved method (i.e., Procedures of Demolition of Multiple Rounds).

#### **6.11 EXPLOSIVE STORAGE MAGAZINES**

Explosives will be procured from a commercial supplier on an as-needed basis; no storage of explosives at the project site is anticipated.



## 7. ENVIRONMENTAL PROTECTION PLAN

USA has prepared this site-specific Environmental Protection Plan to describe the approach, methods, and operational procedures to be employed to protect the natural environment (i.e., minimize pollution, protect and conserve natural resources, restore damage, and control noise and dust within reasonable limits) during all field activities at the project site.

The Phase III EE/CA will consist of a non-intrusive ground reconnaissance and digital geophysical mapping, followed by intrusive anomaly investigations. The project design includes considerable flexibility in selecting the survey locations.

USA will coordinate with the Wil Chee to adjust survey boundaries to protect high-value environmental areas such as threatened and endangered species' habitats, wetlands, and cultural resources if they are identified. Therefore, all project personnel should:

- Be aware of the intent to avoid sensitive environmental sites;
- Actively attempt to identify high-value environmental resources within each selected survey area; and
- Bring the potential presence of high-value environmental resources to the attention of the SUXOS to modify the survey boundaries to avoid entering these areas.

### 7.1 EXISTING ENVIRONMENTAL CONDITIONS

#### 7.1.1 ENVIRONMENTAL SURVEY

The general area of the former Waikoloa Maneuver Area supports a number of sensitive cultural and biological resources. The project area has been surveyed for cultural resources and includes some significant sites (listed or eligible for listing in the National Register of Historic Places), as well as several potentially significant sites. The possibility of affecting several sensitive species that utilize the project site may also exist. Sensitive plants and animals identified by the U.S. Fish and Wildlife Service (USFWS) and the Hawaii Department of Land and Natural Resources (DLNR) may occur in the area and have the potential to be affected by the OE sampling activities.

#### 7.1.2 WETLANDS

No wetlands are present at the project site.

#### 7.1.3 ENDANGERED SPECIES

In 1997, a biological survey of the former maneuver area was conducted by Wil Chee.

One endangered plant or plant species of concern was discovered by the project botanists. Thirty-four individual plants of *Portulaca sclerocarpa* were found on Puu Pa scattered from the base of the Puu to just below its summit.

The Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*) is an endemic species that is listed as endangered by the USFWS and may occasionally fly over the former maneuver area. However, the area does not provide suitable nesting habitat for this species and the species was not observed during this survey.

Hawaiian Goose (*Branta sandvicensis*) is another endemic species that is listed as endangered by the USFWS. These species were not observed during this survey;

however, it is possible that the species may utilize portions of the former maneuver area.

The Hawaiian hoary bat (*Lasiurus cinereus semotus*) is Hawaii's only endemic terrestrial mammal and is listed as endangered by the USFWS and a species of concern for the Hawaiian Islands. This species was not observed during the survey of the former maneuver area.

No threatened or endangered invertebrates were observed or collected in the areas surveyed. Although not considered a threatened or endangered species, the endemic yellow-faced bee (*Hylaeus sp.*) is a species of concern due to its vital role as a pollinator of the rare, native flora, ilima (*Sida fallax*); its limited or threatened habitat; and its vulnerability to predators. It was observed during the survey on ilima flowers in the vicinity of the Puu Pa Maneuver Area. The genus has been considered for listing by the USFWS. The former maneuver area supports little habitat for native and sensitive species due to intense cattle grazing and a variety of anthropogenic stresses.

#### 7.1.4 SPECIAL HABITATS

The Kawelu grassland is the only sensitive habitat within the former maneuver area. Several native Hawaiian plant species occur in the Kawelu grassland (Palmer and Paul, 1999).

#### 7.1.5 CULTURAL RESOURCES

Numerous archaeological investigations have been conducted in this region and have been focused mainly along the coast, the town of Waimea (Kamuela), and the Waikoloa Village.

Numerous prehistoric sites have been identified throughout the former maneuver area. Archaeological sites in the coastal region of the former maneuver area include permanent and temporary habitation structures, rockshelters, petroglyph fields, fishponds, burial sites, and cairns (i.e., trail markers). Inland sites include irrigated fields and ditches, stone platforms, stone walls, possible burial platforms, and prehistoric artifacts (Nees and Williams, 2000).

#### 7.1.6 NATURAL RESOURCES

Clearing of vegetation in support of the geophysical mapping effort could increase erosion of the soil and disrupt or kill small animals within the path of the equipment. Disrupted animals may have life functions temporarily disturbed or may leave the area. Although the disruption should only be temporary, the application of mitigation measures will be employed to reduce impacts.

Geophysical mapping will be performed by pushing/pulling a geophysical array along survey grids and paths within the project area. The impact of the search array may disrupt animals, cause individual mortality, and/or trample some vegetation that is present within the mapped areas. However, effects to biological resources during mapping activities will be minor.

Disruption of mobile species and foraging habitat for raptors could occur. The ground disturbance from OE sampling could destroy animal burrows and cause individual mortality of less mobile species such as nesting birds, small mammals, and reptiles. Depending upon the extent of the required subsurface sampling, the effects to biological resources could be moderate.

Vegetation disturbance may further reduce available foraging habitat and decrease raptor prey populations. This disturbance would be temporary, and there is other available foraging habitat adjacent to the project area.

## 7.2 POTENTIAL APPLICABLE OR RELEVANT AND APPLICABLE REQUIREMENTS

Section 121(d) (1) of CERCLA, as amended by the Superfund Amendments and Reauthorization Act, requires that remedial actions must attain a degree of cleanup that assures the safety of human health and protection of the environment. Moreover, all potential ARARs must be outlined. ARARs include federal standards, requirements, criteria, and limitations under state environmental or facility siting regulations that are more stringent than federal standards.

Although the requirements of CERCLA Section 121 generally apply as a matter of law only to remedial actions, USACE policy for response actions is that ARARs will be identified and complied with to the extent practicable. Three factors are applied to determine whether identifying and complying with ARARs is practical in a particular response situation. These factors include:

- 1) The exigencies of the situation;
- 2) The scope of the response action to be taken, and
- 3) The effect of ARAR compliance on the statutory limits for response action duration and cost.

ARARs are identified on a site-specific basis and involve a two-part analysis; first a determination is made as to whether a given requirements is applicable; if not applicable, examination is made of whether it is nevertheless both relevant and appropriate. When a requirement is found to be both relevant and appropriate, that requirement must be complied with to the same degree as if it were applicable.

USA will perform OE sampling activities at the former Waikoloa Maneuver Area in compliance with all ARARs identified in Table 7-1.

## 7.3 ENVIRONMENTAL PROTECTION AND MITIGATION

All personnel engaged in the surveying, geophysical mapping, and statistical sampling of grids and paths must adhere to the following set of field notes pertaining to the protection of biological and cultural resources within the study area. Table 7-2 identifies roles and responsibilities for proposed mitigation strategies.

- All field personnel will receive a brief orientation from the designated biological and archaeological resources specialists for the EE/CA field effort on the recognition and protection of sensitive flora and fauna and cultural resources that are likely to be found in the study area. The orientation session will take place at the Project Kick-Off meeting, when the geophysical mapping and OE sampling teams arrive to start sampling. Orientation sessions regarding biological/cultural resources will also be necessary in the event that new field personnel are brought to the site during the course of the investigation. It may also be necessary for the monitors to update field personnel each morning during the tailgate safety briefings if significant information on biological/cultural resources issues has changed.
- Sampling grids and paths will be located and surveyed in areas approved by the biological and cultural resources specialists. If the proposed location of a sampling grid or path encompasses sensitive vegetation, habitat of a threatened/endangered species, or culturally significant site, the sampling grid or path will be shifted to avoid the resource.

**Table 7-1. Applicable or Relevant and Appropriate Requirements, Former Waikoloa Maneuver Area**

Requirement	Citation	Description	Type	Comments
<b>Federal</b>				
OE Waste Identification	Draft Department of the Army Memorandum	Adopts criterion of 10 percent explosive content as a measure of contaminated soil reactivity to differentiate between hazardous waste or a secondary explosive.	Action-specific	Soil sampling is not anticipated as part of this investigation.
RCRA Subpart M (Military Munitions Rule)	40 CFR Part 266	Identifies when military munitions become a solid waste, and, if these wastes are hazardous, the management standards that apply.	Contaminant-specific	Recovery, collection, and on-range destruction of UXO and munition fragments are not subject to hazardous waste regulations or permits. OE discovered in burial pits or trenches could be considered solid waste in accordance with the rule. However, this requirement is not applicable until the state implements the federal Military Munitions Rule as a state-implemented federal requirement.
RCRA	40 CFR Part 261.23	Identifies solid waste subject to regulation as hazardous; waste considered hazardous versus explosive would be handled as such.	Contaminant-specific	
OE Waste Identification	USATHAMA AMXTH-TE-CR-86096	Adapts criterion of 12-percent explosive content as a measure of contaminated soil reactivity to differentiate between hazardous waste and explosive waste.	Contaminant-specific	
RCRA, Identification and Listing of Hazardous Wastes	40 CFR Part 261.3	Requires that waste be analyzed to determine if it represents RCRA hazardous waste based on established lists and hazardous waste characteristics, such as reactivity and toxicity.	Action-specific	There is the possibility that an analysis of excavated soils may be required to determine if they are classified as RCRA hazardous waste.

**Table 7-1. Applicable or Relevant and Appropriate Requirements, Former Waikoloa Maneuver Area**

Requirement	Citation	Description	Type	Comments
CWA	33 U.S.C. 1151 et seq., 1251 et seq., 40 U.S.C. 3906 et seq.	Establishes standards governing all untreated waters including marine, coastal, estuarine, fresh surface water, and groundwater; also governs discharge of dredged or fill material.	Location-specific	
CWA (Section 404)	33 CFR Part 320 et seq.	Requires action be taken to minimize loss or degradation of wetlands. Responsible agencies include the USACE, USFWS, and U.S. EPA.	Location-specific	
	40 CFR Part 230.10, Section 404(b)(1)	Requires permit from USACE for construction activities in wetlands and alternative analysis to ensure selection of the least damaging practicable alternative.	Location- specific	
Fish & Wildlife Coordination Act	16 U.S.C. 661 et seq.	Prohibits actions from harming local fish and wildlife	Location-specific	Activities are projected to occur in areas populated with wildlife. Provisions of this Act should be followed.
ESA	16 U.S.C. 1531-1543	Prohibits federal actions from modifying critical habitats or jeopardizing the continued existence of protected endangered or threatened species.	Location-specific	Prior to and throughout the field activities, all steps necessary will be conducted to minimize the impacts to listed plant and animal species and their habitats. All on-site employees will undergo a briefing regarding the species present and measures for precluding impacts to those species and their habitat. The Environmental Protection Plan (Chapter 7) also addresses these issues.
CAAA of 1977 and 1990	42 U.S.C. 7401 et seq. 40 CFR 50 et seq.	Establishes primary and secondary air quality standards necessary to protect health, welfare, plant and animal life, buildings, materials, and visibility. The responsible agency is the U.S. EPA.	Location-specific	

**Table 7-1. Applicable or Relevant and Appropriate Requirements, Former Waikoloa Maneuver Area**

Requirement	Citation	Description	Type	Comments
Floodplain Management	EO 11988	Restricts federal activities when projects are sited in floodplains. The USACE is the responsible agency.	Location-specific	
MBTA	16 U.S.C. 703-712	Prohibits the taking, possessing, buying, selling, or bartering of any migratory bird, including feathers or other parts, nest eggs, or products, except as allowed by regulations.	Location-specific	
ARPA	16 U.S.C. 470	ARPA prohibits unauthorized excavation of, and sets standards for protection of, archaeological resources. Prohibits disclosure of archaeological resources by federal agencies.	Location-specific	If any sites (properties) are uncovered or affected by the fieldwork, proper procedures must be in place under ARPA to evaluate and protect cultural resources.
NHPA	16 U.S.C. 470	Requires action to be taken to locate, identify, evaluate, and protect cultural resources.	Location-specific	If additional properties are uncovered or existing sites affected by the OE sampling, conditions of the NHPA must be followed.
Protection of Wetlands	EO 11990	Restricts federal activities when alterations of wetlands may occur.	Location-specific	Prior to removal of OE from wetland areas, action must be taken to minimize impacts. Mitigation and habitat restoration plans include measures to minimize disturbance to wetlands. The goal of restoration plans will be to restore affected wetlands to the original acreage so that they provide the same function as prior to ordnance removal.
CERCLA	42 U.S.C. 9601-11050	Legislation that finances remediation and creates a national policy to identify and clean up sites contaminated by the release of hazardous substances.	Action-specific	Provides factors to be considered in determining the appropriate removal action and specifies that public affairs must be coordinated in accordance with directives for the CERCLA response action.

**Table 7-1. Applicable or Relevant and Appropriate Requirements, Former Waikoloa Maneuver Area**

Requirement	Citation	Description	Type	Comments
OSHA	29 CFR Part 1910.120	Defines the manner in which hazardous waste and emergency response actions must be carried out. Covers emergency response operations for the release of, or substantial threat of, hazardous substances without regard to the location of the hazard.	Action-specific	The possibility of a fire or explosion will exist during OE sampling operations. All site personnel must be in compliance with 29 CFR Parts 1910.120, which requires workers to be 40-hour health and safety trained with an 8-hour refresher. An annual medical surveillance examination is also required.
Hazard Communication	29 CFR Part 1910.1200	Specifies that the hazards associated with all chemicals produced or imported be evaluated, and that information concerning their hazards be transmitted to employers and employees.	Action-specific	All on-site employees and visitors will be made aware of the hazards associated with the chemicals on site and the hazards associated with the OE sampling activities.
Hazardous Substance	49 CFR Part 172.101	Details DOT classifications of hazardous material.	Action-specific	Transportation of explosives to be used in the detonation of UXO as a means of on-site disposal must comply with DOT regulations. UXO-qualified personnel must inspect the loading and unloading of the explosives, and the transport vehicle must be properly maintained and placarded.
RCRA	Subtitle C, D, I	Requires action toward an imminent hazard to protect human health and the environment.	Action-specific	
Federal Transportation Act	49 CFR Part 172.101	The DOT considers OE "hazardous material" for manifesting purposes under the DOT regulations	Action-specific	Transportation of explosives to be used in the detonation of OE as a means of on-site disposal must comply with DOT regulations. UXO-qualified personnel must inspect the loading of the explosives, and the transport vehicle must be appropriately placarded.

**Table 7-1. Applicable or Relevant and Appropriate Requirements, Former Waikoloa Maneuver Area**

Requirement	Citation	Description	Type	Comments
NEPA	40 CFR Parts 1500-1508	Requires that public officials and citizens be informed of proposed actions so that informed decisions can be made (i.e., the analysis of cumulative effects and impacts on cultural/natural resources).	Action-specific	
NCP	40 CFR Parts 300.120(c), 300.400(e)	Defines format for response from planning to decision making to post-removal monitoring.	Action-specific	Permitting is not required for on-site CERCLA response actions.
Public Affairs	40 CFR Part 300	Public affairs coordination must be conducted in accordance with directives for the CERCLA response action	Action-specific	
CERCLA	40 CFR Part 300.415	Provides factors to be considered in determining the appropriate removal action.	Action-specific	
Detection Technology	EP 110-1-16 (Draft)	Provides guidance for selecting appropriate technology based on physical properties of ordnance and site conditions.	Action-specific	
Safety Practices and Disposal	DOD 6055.9-STD	Requires specialized personnel in the detection, removal, and disposal of OE; stipulates required safety precautions and procedures for detonation/disposal.	Action-specific	
Transportation	49 CFR Parts 100-199 TM 9-1300-206	Regulates transport of hazardous substances in Hawaii.	Action-specific	
Federal Transportation Act	49 CFR Part 172.101	The DOT considers OE "hazardous material" for manifesting purposes under the DOT regulations.	Action-specific	Transportation of explosives to be used in the detonation of OE as a means of on-site disposal must comply with DOT regulations. UXO-qualified personnel must inspect the loading of the explosives, and the transport vehicle must be appropriately placarded.

**Table 7-1. Applicable or Relevant and Appropriate Requirements, Former Waikoloa Maneuver Area**

Requirement	Citation	Description	Type	Comments
OSHA	29 U.S.C. 651-678	Regulates worker health and safety.	Action- specific	Under 40 CFR Part 300.38, requirements of the Act apply to all response activities under the NCP.
SARA	Chapter 160	Established the DERP that calls for "correction of environmental damage (such as detection and disposal of UXO) that creates an imminent and substantial endangerment to the public health or welfare or the environment."	Action- specific	The contamination of this project area was the result of past activities conducted by the U.S. military and constitutes a hazard to human health and the environment.
<b>State</b>				
Hazardous Waste	Hazardous Waste JRS [Title 19] 342J	Provides classification of hazardous waste. Regulates generators, transporters, and treatment, storage, or disposal facilities.	Contaminant-specific	
Wildlife	HRS (Title 12) 195	Provides for the protection of wildlife.	Location- specific	
Historic Preservation	HRS (Title) 6F	Requires action to be taken to locate, identify, evaluate, and protect cultural resources.	Location- specific	
Requirement	Citation	Description	Type	Comments
Public Access to Coastal and Inland Recreation Areas	HRS (Title 9) 115, HRS 205A	Establishes and regulates public access to coastal and inland areas.	Location- specific	
Forest Reservations, Water Development, Zoning	HRS (Title 12) 183	Regulates activities in forested land and watersheds.	Location- specific	
Statewide Trail and Access System	HRS (Title 12) 198D		Location- specific	

**Table 7-1. Applicable or Relevant and Appropriate Requirements, Former Waikoloa Maneuver Area**

Requirement	Citation	Description	Type	Comments
EIS	HRS (Title 19) 343	Prescribes the applicability and requirements for environmental assessments and impact statements in Hawaii.	Location- specific	
Transportation of Hazardous Materials, Hazardous Waste, and Etiologic Agents	HRS (Title 17) 286	Regulates transport of hazardous substances in Hawaii.	Action- specific	
Hazardous Waste Management	HAR II-260-266, 268, 270, 271, 280	Regulates waste management in Hawaii.	Action- specific	

**Acronyms and Abbreviations**

ARPA = Archaeological Resources Protection Act	HAR = Hawaii Administrative Rules
CAAA = Clean Air Act Amendments	HRS = Hawaii Revised Statutes
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act	MBTA = Migratory Bird Treaty Act
CFR = Code of Federal Regulations	NCP = National Oil and Hazardous Substance Pollution Contingency Plan
CWA = Clean Water Act	NEPA = National Environmental Policy Act
DERP = Defense Environmental Restoration Program	NHPA = National Historic Preservation Act
DOD = Department of Defense	OE = ordnance and explosives
DOT = Department of Transportation	OSHA = Occupational Safety and Health Administration
EIS = environmental impact statement	RCRA = Resource Conservation and Recovery Act
EO = Executive Order	SARA = Superfund Amendments and Reauthorization Act
EPA = Environmental Protection Agency	TBC = to be considered
ESA = Endangered Species Act	TM = Technical Manual
	USACE = U.S. Army Corps of Engineers
	U.S.C. = U.S. Code
	USFWS = U.S. Fish and Wildlife Service
	UXO = unexploded ordnance

**Table 7-2. Roles and Responsibilities for Implementing Avoidance Measures for Protecting Biological and Cultural Resources**

Measure Description	Responsible Party	Implementation Period
Training of field personnel on recognition of sensitive biological and cultural concerns	USA USACE Honolulu District	Start of surveying Start of sampling Daily tailgate safety briefings.
Shifting of lanes or selection of alternate lanes to avoid biological/cultural concerns.	USA	During surveying of sampling grids and paths.
Construction of temporary protective measures (e.g., ramped wall of sand bags).	USA	Evaluated on a case-by-case sampling of grids and paths
Communication of biological/cultural concerns within the exclusion zone to biological/cultural monitors.	USA	During intrusive work when exclusion zone is in place.
Inspection of excavations and debris collected from grids/paths.	USACE Honolulu District	As sampling progresses and grids/paths are completed.
Documenting the pre-existing condition of vegetation and subsequent condition of vegetation in the grids/paths (if required)	USACE Honolulu District	Prior to and subsequent to subsurface sampling.
Cessation of fieldwork due to archaeological finds or unavoidable impact to threatened or endangered species.	USA USACE Honolulu District USAESCH	During subsurface sampling grids/paths.
Delineation of sensitive vegetation, wildlife, or archaeological features to be avoided by field personnel.	USA USACE Honolulu District	Throughout entire investigation.
Notification of dead, sick, or injured animals.	USA USACE Honolulu District	Throughout entire investigation.

- In the event that an OE item is uncovered that must be destroyed in-place and the item is situated close enough to a cultural resource that must be protected, special precautions will be taken to protect the cultural resource from the blast. Implementation of precautionary measures such as constructing a temporary ramped wall of sandbags between 2-3 feet in height or other mitigation measures will be determined on a case-by-case basis. If there is the need to destroy an OE item in place, the mitigation measures must be approved by the archaeological and biological resources specialists. Mitigation measures that USA will propose will depend on the type of OE item found and the distance the OE item is from the resource.

- 
- During OE sampling activities that require establishment of an exclusion zone, only personnel that are OE-qualified will be permitted within the exclusion zone. This restriction also includes biological and archaeological resources specialists, who will not be permitted within the exclusion zone. During sampling activities, field personnel in the exclusion zone will keep the Command Post informed of their progress and if any significant biological and cultural concerns have been encountered. The Command Post will keep the biological and archaeological resource specialists informed of the sampling teams' progress within the exclusion zone.
  - Unless specifically directed otherwise by the archaeological resources specialist, excavations created during the subsurface sampling for OE items will be promptly backfilled so that the open excavations do not create a safety hazard. Debris removed from each sampling grid or path will be stockpiled at a mutually agreed-upon location so that the archaeological resources specialist has an opportunity to inspect the debris before the debris is commingled in the scrap pile and hauled to a scrap metal recycler.
  - If significant destruction is anticipated to existing vegetation within a sampling grid or path, the biological resources specialist will be responsible for documenting the pre-existing condition of vegetation within each sampling lane. Documentation of the pre-existing condition of vegetation is important, particularly in areas where vegetation may have to be removed in order to facilitate the geophysical investigation or statistical sampling. The biological resources specialist will be responsible for post-documentation of vegetation disturbance .
  - Field personnel will be instructed that if they encounter an archaeological artifact or a threatened/endangered species, as described during the orientation session, they will halt work in the immediate vicinity and notify the USA Site Manager, who will consult with the appropriate biological or archaeological resources specialist. If it is determined that field personnel intentionally failed to notify the appropriate personnel of biological or cultural concerns, that action may result in the person(s) responsible being removed from the field investigation.
  - Where possible, field personnel will access the sampling grids and paths by the route that causes the least damage to the existing vegetation and areas of cultural significance, as identified by the biological and archaeological resources specialists. If the resource specialists find it necessary to delineate sensitive vegetation or an archaeological site so that it can be avoided, field personnel will avoid the delineated area.
  - If, during the course of fieldwork, field personnel encounter dead, sick, or injured animals, they will immediately notify the USA Site Manager and UXOSO.

#### 7.3.1 ENDANGERED AND THREATENED SPECIES

A number of measures that vary in effectiveness and cost are available to mitigate impacts to biological resources. These range from avoidance to on-site monitoring and species removal or protection. Table 7-3 identifies possible mitigation strategies to lessen or eliminate impacts to biological resources. However, the final approved activities and results of the mitigating actions will be implemented as appropriate.

**Table 7-3. Possible Mitigation Strategies for Biological Resources**

Strategy	Avoidance	Monitoring
Procedure	1. Pre-Surveys to avoid sensitive resources (use alternate survey paths)	1. Full-time Monitor
	2. Worker Education	2. On-call Monitor
Effectiveness	1. Most resources can be identified and avoided	1. All resources would be identified before affected.
	2. Educate field personnel to environmental sensitivities. Good for avoiding unanticipated resources.	2. Most resources could be avoided through preserving, marking; possible risk to individual species.

**Reasons for Mitigating Actions.** Section 7 of the Endangered Species Act (ESA) prohibits the take of listed species without an incidental take permit. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns including breeding, feeding, or sheltering. Under the terms of Section 7(b)(4) and 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the incidental take statement. Although direct take is not expected, alteration of foraging habitat could be minimized.

Section 2 of the Migratory Bird Treaty Act (MBTA) prohibits, at any time, by any means, or in any manner, the pursuit, hunting, take, capture, killing, or any attempt to take, capture, or kill migratory birds protected by the MBTA, except as exempted by Federal and state regulations. Until recently, only regulatory agencies had promoted project compliance with the MBTA. Compliance with the MBTA is currently under greater scrutiny, as recent circuit court decisions have upheld private interest group claims of MBTA violations by project proponents in Texas and other states. The proposed project could have impacts on birds protected by the MBTA as stated above.

**Worker Education Briefing.** Prior to commencement of field activities, all on-site personnel will be briefed on health and safety issues and the ecology of sensitive species in the area. Methods for minimizing potential impacts to these species will form an integral part of the on-site training.

**Mitigation by Avoidance.** Incorporated into the OE sampling methods will be sensitive area and sensitive species mitigation by avoidance when possible. In order to comply with the MBTA, disturbance of nesting and breeding activities could be avoided by restricting project activities to the non-breeding season. Pre-project surveys should be conducted if activities are occurring during the nesting season (March-September) in areas where transects may affect nests to ensure MBTA-listed species protection.

**Minimize Vehicle Impacts.** The movement of heavy machinery (e.g., backhoe) across the terrain could result in extensive damage to area vegetation. To minimize these impacts, equipment will use a single-site entry and exit pathway. Additionally, mitigation will be implemented to restore these pathways to the pre-used condition.

**Minimize Terrain Alteration.** All excavations should be backfilled and returned to the natural contours following EE/CA fieldwork. Erosion control for wind and water effects will be employed, as required. However, only manual tamping or compaction will be required. During backfills, the original top soil and vegetation will be returned to the excavation to promote an original pre-excavation condition.

**Minimize Vegetation Impacts.** Disturb only areas necessary to conduct EE/CA activities.

### 7.3.2 WETLANDS

Section 404 of the Clean Water Act (CWA) provides the regulatory mechanism necessary to minimize or avoid wetland impacts resulting from reuse. Section 404 of this act does not apply to this project because no wetlands are present at the project site.

### 7.3.3 CULTURAL AND ARCHAEOLOGICAL RESOURCES

This project will be coordinated with the Hawaiian State Historic Preservation Officer (SHPO) through the USACE Honolulu District.

Ground-disturbing activities associated with geophysical mapping, and OE sampling activities, may have the potential to affect cultural resources present within the project area. Vehicular traffic, anomaly excavation, and/or in-place detonation of OE could diminish the integrity of or completely destroy these sensitive resources. Therefore, application of mitigation measures will be employed to minimize impacts.

In compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, an archaeological monitoring and limited sampling plan for OE activities on the Waikoloa Maneuver Area will be provided by an archaeological subcontractor.

Several archaeological investigations have been conducted in conjunction with other projects in the vicinity of the proposed OE activities.

Cultural resources require archaeological surveys, even though the proposed work areas have been affected by historic cattle ranching and military maneuvers. Cultural resources will be largely protected through avoidance. OE investigations will largely be contained in designated survey grids and paths in areas that have been surveyed by qualified archaeologists. Only those areas that have been identified as suitable for testing by an archaeologist will be investigated by OE personnel. Cultural resources specialists will also educate OE personnel on identification of resources prior to commencing test activities. Archaeologists will be available on standby to recover datable remains and assess pre-contact cultural resources, if any are present.

USA will evaluate the locations requiring excavation after the analysis of the geophysical survey data. Each grid will be examined during intrusive investigations for cultural significance. The following listed items are examples of what the site personnel will be aware of:

- 
- Indication of artifact belonging to native Hawaiian, e.g., tools, pottery;
  - Items of historical significance, e.g., rock monuments, burial sites

If such resources are discovered, field crew members are responsible for immediately notifying the Site Manager, who will adjust the site boundaries to avoid the resources and will notify the USACE Honolulu District of the findings.

All known cultural resources will be avoided to the extent possible during the planning process and subsequent OE sampling activities. The boundaries of all known cultural resources will be delineated so that they can be protected during geophysical mapping and OE sampling. Site damage by vehicular traffic will be reduced by utilizing existing trails and pathways. Abandoned roads may be used to the extent possible when such traffic will not have an additional impact on resources along their margins. Sites uncovered during sampling will require identification and evaluation, and a determination of effect needs to be developed before appropriate mitigation measures can be finalized. Table 7-4 identifies possible mitigation strategies to lessen or eliminate any impacts to cultural resources.

**Reasons for Mitigating Actions.** Numerous laws and regulations require federal agencies to consider the effects of a proposed undertaking on cultural resources. The primary law governing cultural resources is the NHPA (Public Law 93-91), which addresses protection of historic and cultural resources. Section 110 of the NHPA mandates that all federal agencies carry out a cultural resources program to identify and preserve historic properties under their ownership or control. Section 110 of the NHPA requires each agency to consider the effects of its actions on historic properties and seek comments from the Advisory Council on Historic Preservation (Council). The Section 110 review process is coordinated with the governor-appointed SHPO.

**Worker Education Briefing.** Prior to commencement of ordnance removal, all on-site personnel will be briefed on the sensitivity of cultural resources in the area. Methods for minimizing potential impacts to cultural resources will form an integral part of the on-site training.

#### 7.3.4 WATER RESOURCES

Water resources will be identified in the GIS prior to the start of field activities. Survey grids will be selected to avoid all such resources.

Flood plain protection is mandated by Executive Order 11988. It is not anticipated that the UXO survey will result in any direct or indirect development within flood plains.

#### 7.3.5 COASTAL ZONES

USA does not anticipate that the Phase III EE/CA efforts will impact the coastal zone and has not made provision to mitigate any potential impacts.

#### 7.3.6 TREES AND SHRUBS REMOVED DURING FIELD ACTIVITIES

USA does not anticipate the need for tree removal in the former Waikoloa Maneuver Area. USA may have to trim trees in certain areas to allow the geophysical survey teams sufficient room to operate. However, USA will adjust the survey boundaries to greatest extent practicable to avoid wooded areas.

**Table 7-4. Possible Mitigation Strategies for Cultural Resources**

Strategy	Avoidance		Preservation	Resources Data Recovery
	On-Call Monitoring <sup>(a)</sup>	Full-Time Monitoring <sup>(b)</sup>	Identification/Evaluation	Recordation/Recovery
Procedure	Monitor will investigate any unanticipated resources or anomalies as they occur.	All resources will be avoided to the extent possible through identification by monitor and coordination with field crews prior to ground-disturbing activities.	Identify area that contains the significant resource to be avoided. Evaluate for eligibility to National Register of Historic Places. Implement protection measures as appropriate.	Document the resource through mapping and photo recordation. Conduct excavation to recover data in accordance with data recovery plan approved by SHPO.
Effectiveness	Most unanticipated significant resources can be identified and recorded as they are encountered.	All significant resources can be identified and avoided as encountered.	Any significant resources will be preserved in place; will not facilitate removal of all OE.	Adequate sample of data from significant resource will be collected, analyzed, documented, and archived.
Burden/Cost	Relative low cost; some cultural resources could be affected.	Moderate cost; less potential for resource loss/impact.	Moderate cost, but inefficient for removal of OE.	Very expensive; health and safety concerns for archaeological field personnel if conducted concurrently with OE activities.
Notes: (a) A part-time monitor will only travel to the job site when unanticipated/potential cultural resources are identified. (b) A full-time monitor will support field operations associated with this EE/CA investigation. SHPO = State Historic Preservation Officer OE = ordnance and explosives				

### 7.3.7 EXISTING WASTE DISPOSAL SITES

USA does not anticipate encountering any waste disposal sites in the Phase III EE/CA sectors. However, the potential for encountering waste disposal site exists. USA will avoid all known, non-OE disposal sites to the greatest extent practicable.

It is anticipated that any existing waste disposal sites at the former Waikoloa Maneuver Area will be small and that the contents will be limited to household-type rubbish. However, discarded glass and metal could represent a safety hazard to field team members. Therefore, field crews should avoid all such sites and should notify the Site Manager if any such sites are discovered. Site avoidance may consist of adjusting the survey area boundaries, or working around existing waste disposal sites within the survey area.

### 7.3.8 MANIFESTING, TRANSPORTATION, AND DISPOSAL OF WASTES

USA will process OE and ordnance scrap for final disposition as scrap metal in accordance with Section 3.9.11 and Attachment 1 of the SOW. Transportation of scap metal does not require manifesting.

USA will turn-in non-ordnance related waste (e.g., paper, food and beverage containers, uncontaminated protective clothing, etc.) to a commercial or municipal disposal facility.

In the event of a spill of petroleum products which requires cleanup, USA will coordinate with the Phillips Services (1-215-643-5466) for the proper packaging, manifesting, and shipment of the material.

### 7.3.9 BURNING ACTIVITIES

USA will not perform any burning activities during the Phase III EE/CA of the former Waikoloa Maneuver Area.

### 7.3.10 DUST AND EMISSION CONTROL

Dust sources during UXO surveys at the former Waikoloa Maneuver Area primarily will result from excavation during intrusive operations. However, vehicular traffic, traveling in and out of the site, may produce some dust. Dust control measures will include the following:

- To the maximum practical extent, travel will be performed on paved roads. To minimize dust generation on dirt roads, speeds will be restricted to the posted or recommended speed limit.
- If any detonations of UXO are required engineering controls will be used to limit the noise, fragments and smoke from the disposals.
- Emission sources include vehicles and heavy equipment. All vehicles and equipment will be in good working order and will meet applicable vehicle emissions requirements.

### 7.3.11 SPILL CONTROL AND PREVENTION

All fueling and maintenance of the motorboat, vehicles, and the backhoe will be performed offsite at appropriate commercial or private facilities. During site activities, the hoses, drive train, and hydraulic components of the backhoe will be inspected

daily for signs of leaking fluids. If leaks are found, the backhoe must be removed from the site and repaired before it can be used again at the site.

If a severe leak of fuel or other fluids such as hydraulic or transmission fluid occurs in the field the following procedures will be implemented.

- Promptly berm the site with dirt so that the fuel or fluid does not spread along the ground surface.
- Apply oil-absorbing material such as sawdust or kitty litter to the spill.
- Report the spill to the USACE OE Safety Specialist, SUXOS, or UXOSO and follow USA instructions for spills cleanup. It is anticipated that this usually will involve digging up and drumming contaminated soil, and subsequently disposing of it in an approved landfill.

Gasoline will be transported only in DOT-approved gas cans. The cans will not be filled to more than three-quarters full to prevent overfilling at the commercial service station and to prevent spillage if they are opened in the field. Absorbent material and a ground barrier such as plastic will be used if oils or fuels are placed on the site.

#### 7.3.12 STORAGE AREAS AND TEMPORARY FACILITIES

USA does not plan to store explosive on any sites within the former Waikoloa Maneuver Area. USA will coordinate with USACE Honolulu District for a location to use as a storage facility for equipment during non-work times.

Temporary facilities will be limited to office trailers located as close to the work site as possible. Mitigation procedures will be performed as necessary when the temporary field facility is demobilized.

#### 7.3.13 ACCESS ROUTES

Existing roads will be used to the maximum extent possible. However, it may be necessary to drive through areas without roads for access. In such cases, the following measures will be taken to minimize the environmental effects.

During field operations, USA will attempt to perform all operations when the ground is dry and passable. This will substantially reduce the potential for creating ruts in soft soils.

#### 7.3.14 TREES AND SHRUBS PROTECTION AND RESTORATION

It is unlikely that any trees will be removed during the EE/CA UXO survey. Therefore, no provisions are required for tree restoration.

#### 7.3.15 CONTROL OF WATER RUN-ON AND RUN-OFF

The UXO operations should not alter drainage patterns. Excavations are to be backfilled as soon as possible to help prevent water and soil runoff from occurring. In the event that an excavation must be left open, engineering controls such as sandbags, plastic sheeting, and hay may be used to help divert water, through the use of berms, and coverings to keep soil from migrating offsite.

7.3.16 DECONTAMINATION AND DISPOSAL OF EQUIPMENT

Except for UXO, this project does not involve any hazardous materials or hazardous wastes. Any UXO that is found during the EE/CA will be disposed of by detonation. Mitigation will involve filling in any holes resulting from detonation.

Disposal of non-hazardous materials and equipment will not require decontamination or mitigation.

7.3.17 MINIMIZING AREAS OF DISTURBANCE

Procedures for minimizing areas of disturbance are described throughout this Environmental Protection Plan and include such measures as:

- Driving on established roads as much as possible and limiting vehicle trips in areas without roads;
- Avoiding wetlands and riparian areas; and
- Replacing soil into holes that result from the detonation of UXO.

7.3.18 POST-ACTIVITY CLEAN-UP

All wastes will be removed from each site immediately upon completion of daily field activities. Therefore, no post-activity clean-up will be required.

7.3.19 AIR MONITORING

Air monitoring is not included in the SSHP, since the Phase III EE/CA task does not require air monitoring.



## 8. PROPERTY MANAGEMENT PLAN

This Property Management Plan (PMP) has been prepared in accordance FAR Part 45.5 and its supplements. At this time it is not anticipated that any Government Furnished Equipment (GFE) will be utilized.

The objective of this plan is to ensure control and accountability procedures for all aspects of the equipment used during the project separated into field equipment (Table 8-1), office equipment (Table 8-2) and consumables (Table 8-3).

USA has prepared for the USAESCH a Contractor Acquired/Government Furnished Property Control System for DACA87-00-D-0036.

### 8.1 DESCRIPTIONS AND QUANTITIES

Equipment and materials used during this project will primarily be limited to field equipment due to the short duration anticipated. Minimal office equipment needed for generating forms and reports will be located at the lodging facility. All other command center operations will be conducted by USA Tampa. To perform this project the following equipment will be utilized:

**Table 8-1. Field equipment**

Equipment Item	Quantity	User
F-150	2	SUXOS/UXOSO/UXOQCS
F-150	2	Investigation Teams
Whites Spectrum XLT	5	Survey/Sweep Teams
Camera Equipment	1	SUXOS
Handheld Radios	5	SUXOS, UXOSO, USACE Safety, Investigation Teams
Cellular Telephone	2	SUXOS/UXOSO/UXOQCS
First Aid, Portable Eyewash	4 ea	Each Vehicle
Blasting equipment	1 set	Demolition Team
Fire Suppression Equipment	4	1 for Each Vehicle, 2 10BC for DEMO
Storage Container	1	Site Personnel

**Table 8-2. Office Equipment**

Equipment Item	Quantity	User
Computer	1	SUXOS, UXOSO, Survey
Printer	1	SUXOS, UXOSO, Survey

Table 8-3. Consumables

Equipment Item	Quantity	User
PPE (Gloves, Glasses)	5ea	All USA and Sub-Contractors
Excavation Equipment (Shovels, Trowels, Buckets)	2ea	Investigation Teams
Log Books, Computer Accessories	1set	SUXOS, UXOSO
Administrative Supplies	As Needed	SUXOS, UXOSO

**8.2 SOURCES AND ACQUISITION**

In support of the pending field activities USA contacted local suppliers for availability and costs of required rental equipment. Upon receipt of NTP USA will contact the suppliers to confirm availability and secure rates.

**8.3 DOCUMENTATION**

Not applicable, FFP contract.

**8.4 BASIS OF SELECTION**

Not applicable, FFP contract.

**8.5 VEHICLE ALLOWANCE**

Not applicable, FFP contract.

**8.6 CONSUMABLES AND PERSONAL PROPERTY**

Not applicable, FFP contract.

**8.7 STORAGE PLAN**

Due to the short duration of the project no temporary on site storage facilities will be placed. Expensive Equipment that will require daily maintenance will be brought out from and returned to the lodging facilities on a daily basis.

**8.8 ULTIMATE DISPOSITION**

Other than vehicles, equipment used during this project will be the property of USA and will be returned to USA Tampa at the end of the project. If it becomes necessary to use GFE then this equipment will be cleaned, tested and returned to the Government in an operable condition forgiving normal wear and tear. Leased and rented equipment will be returned to the supplier at the end of the project.

Any materials generated as a result of field excavations or daily operations will be evaluated, classified (scrap, recyclable, sanitary waste) and disposed of in accordance with the SOW and Federal, state and local regulations.

**8.9 PROPERTY TRACKING LOG**

A property-tracking log will be generated during this project to capture expenditures from USA acquired property that is directly charged to the project. These expenditures are logged on a USA generated Petty Cash Voucher that will aid in the building of this log. The log will list all purchased equipment, price, location and final disposition. An example of a log is shown.

USA Environmental, Inc 5802 Benjamin Center Drive, Suite 101 Tampa, FL 33634				Property Tracking Log  Contract # DACA87-00-D-0036 Task Order # 0016	
No.	Equipment Item	Date	Price	Location	Condition
1	Chaps	7/12/01	\$69.00	Wingate Project Site	Operable
2					
3					
4					
5					
6					
7					
Example					
This property log will be maintained as needed and audited weekly. The equipment will be verified and discrepancies will be noted and the Contracting Officer and USA Tampa will be notified.					
Project Manager or Senior USA Employee Signature _____					

**8.10 PROPERTY LOSS, DAMAGE OR DESTRUCTION NOTIFICATION**

USA will notify the Contracting Officer and USA Tampa by telephone immediately in the event that any GFE is lost, damaged or destroyed. USA will initiate an immediate investigation into the incident. The Contracting Officer and USA Tampa will be notified in writing within 24 hours.

**8.11 GEOPHYSICAL SURVEY AND OE/UXO CLEARANCE EQUIPMENT**

For DGM survey, the survey will be conducted using the Geonics EM61 MKII based on the results of the former Waikoloa Maneuver Area GPO (USA October 2003). The Whites Spectrum XLT metal detector will be used for purposes such as screening for advancement of grid corner stakes or land survey monuments, selection of the test plot location(s), and for UXO avoidance. In addition, all intrusive investigation of DGM will be conducted by the UXO teams to pinpoint the anomaly with the Spectrum XLT.

A detailed discussion of the applications of the geophysical instruments anticipated to be used during this project are provided in the Geophysical Investigation Plan (Section 3.6).

**8.12 TRANSPORTATION AND CONSTRUCTION EQUIPMENT**

USA does plan to use vehicles for moving project equipment into the interior or the site. USA plans to leave vehicle on the unimproved roads during the field operations of the EE/CA project. USA does not plan to bring onto the project site any heavy equipment to perform intrusive investigations due to the sensitive nature of the desert environment.

Transportation of OE/UXO onsite over unimproved roads using conventional vehicles will be in accordance with the Explosive Management Plan (Chapter 5), the project SSHP (Appendix D), and USAESCH guidance.

### **8.13 ANALYTICAL AND MONITORING EQUIPMENT**

Specific monitoring instruments may be needed for evaluating physical hazards such as noise, heat, or cold stress. Monitoring equipment planned for this site is discussed in the SSHP (Appendix D).

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## 9. REFERENCES

AR 385-64, Ammunition and Explosive Safety.

Army TM, 60A-1-1-31, *EOD Disposal Procedures*.

ATF 5400.7, Alcohol, Tobacco and Firearms Explosives Laws and Regulations.

CEHND 1115-3-524, *Removal Action Planning for OEW Sites Procedural Document*, January 1995.

Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S. Code Sections 9601-11050.

CX Guidance Document 97-08, *Contracting for Ordnance and Explosives (OE) Response Projects*, 20 August 1997.

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**APPENDIX A      SCOPE OF WORK**



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**STATEMENT OF WORK  
OE ENGINEERING EVALUATION AND COST ANALYSIS (EE/CA)  
WAIKOLOA MANEUVER AREA - PHASE III EE/CA  
KAMUELA, ISLAND OF HAWAII, HAWAII  
PROJECTS NO. H09HI035902  
20 February 2003**

**1.0 OBJECTIVE:** The primary objectives of this EE/CA are to conduct OE characterization in areas within and abutting the Waikoloa Maneuver Area, and to incorporate all other relevant data that has developed since completion of the Phase II EE/CA Report. This task order involves ground reconnaissance over approximately 6600 acres, and subsequent geophysical investigation in areas where OE evidence was discovered during the Recon. An addendum to the existing Phase II (EE/CA) Report and Action Memorandum will be prepared.

**2.0 BACKGROUND:** The work required under this Scope of Work (SOW) falls under the Defense Environmental Restoration Program - Formerly Used Defense Sites (DERP-FUDS). Ordnance and Explosives (OE) exists on property formerly owned or leased by the Department of Army.

**2.1** Ordnance and Explosives (OE) is a safety hazard and may constitute an imminent and substantial endangerment to site personnel and the local populous, thus the applicable provisions of 29CFR 1910.120 apply. During this EE/CA, it is the Government's intent that the contractor destroy all OE encountered on-site and that the contractor's work is to be performed in accordance with the Comprehensive Environment Response, Compensation, and Liability Act (CERCLA), Section 104 and the National Contingency Plan (NCP), Sections 300.120(d) and 300.400(e).

**2.2** Due to the inherent risk for OE operations, UXO personnel working on OE operations for the contractor shall be limited to a 40-hour workweek for actual UXO field operations with any workday not to exceed 10-working hours total. Forty-eight (48) hours of rest must separate each 40-hour UXO field operation workweek.

**2.3 Recovered Chemical Warfare Materiel (RCWM).** The site is not suspected to contain Recovered Chemical Warfare Materiel (RCWM). However, if suspect RCWM is encountered during any phase of site activities the Contractor shall withdraw upwind from the work area, secure the site and contact the Corps of Engineers, CEHNC-OE Safety for assistance and guidance.

**2.4 Location** The Waikoloa Maneuver Area is located on the Big Island of Hawaii, between the villages of Waimea and Waikoloa, running roughly from the ocean on the west to the foothill to the east. The former Waikoloa Maneuver area covers some 105,000 acres of land area, and several different soil and ground conditions.

**2.5 History** The U. S. Navy through a licensing agreement with Richard Smart of Parker Ranch acquired 91,000 acres in Waikoloa in December 1943. It was used as an artillery firing range on which live ammunition and other explosives were employed, with the remaining acreage utilized for troop maneuvers, and the largest encampment on the island of Hawaii consisting of approximately 467 acres of tents and Quonset huts. The 2nd Marine Division was assigned to Waikoloa in December 1943 for five months of training, in preparation for the Saipan-Tinian campaign. The 5th Marine Division began arriving in August 1944 at the camp vacated by the 2nd Marine Division. Property comprising the Waikoloa Maneuver Area was surrendered to the Parker Ranch in September 1946, although the Marines had departed as of 30 June 1946. At least two ordnance clearance efforts were conducted, one in 1946 just prior to the departure of the 5th Marine Division, and the other in 1954 following accidental detonation of a dud fuse or shell killing two civilians and seriously injuring three others. The 1954 effort detected as many as 400 dud items including hand grenades, 60 and 81 mm mortars, 75 mm shells, and 105 and 155 mm shell fuses, 31 mm anti-tank cannon shells, and 4.2 inch mortars. OE continues to be discovered at the former Waikoloa Maneuver Area as development progresses. OE may be buried beneath the site or be on the ground surface and could still be capable of functioning. In the mid-to-late 1960's Parker Ranch subsequently sold off two parcels (Puako and Ouli) to the present owners, Nansay Hawaii, Inc., which purchased fee simple title to the properties in April 1990. Nansay Hawaii, Inc. plans to construct golf communities thereon. Construction of a residential subdivision at the Ouli parcel of the Nansay Hawaii site is currently ongoing while the Puako parcel remains vacant and undeveloped.

**2.6 Current Site Use** The property of Waikoloa Maneuver Area is used for residential neighborhoods, cattle grazing and other agricultural and farming applications. There are schools, condominiums, highways, and a wind farms located within the boundaries of this project site.

**2.7 Previous OE Actions** Two previous phases of this EE/CA have already been performed at Waikoloa. A surface clearance of OE was completed at the Ouli Parcel, and the Corps of Engineers is currently providing construction support for several private development projects that are underway at Waimea and Waikoloa Village. There will also be an ongoing Removal Action task (under a separate contract), that may develop information that will be valuable for this EE/CA.

**2.8 Potential Ordnance** The list of potential ordnance items includes hand grenades, 60 and 81 mm mortars, 75 mm shells, and 105 and 155 mm shell fuses, 31 mm anti-tank cannon shells, and 4.2 inch mortars. OE continues to be discovered at the former Waikoloa Maneuver Area as development progresses. This was a land based maneuver and training area, as well as a naval gunnery site.

**3.0 SPECIFIC REQUIREMENTS** The areas identified in Table 1 (Sectors 15, 16, and 17) are to be evaluated under this SOW.

Sector No.	Sector - Parcel Description	Acreage	Base	Option 1
	Phase I Investigation	521	0	0
	Phase II Investigation	107878	0	0
<b>15</b>	<b>Hawaiian Homelands Area</b>	<b>1114</b>	0	0
<b>16</b>	<b>Area North of Kawaihae Road</b>	<b>3000</b>	0	0
<b>17</b>	<b>Area West of Queens Kaahumanu Highway</b>	<b>2500</b>	0	0

**3.1 (TASK 1) TECHNICAL PROJECT PLANNING (TPP)– (FFP)** In coordination with the Government, the Contractor shall implement the Technical Project Planning (TPP) process in accordance with EM 200-1-2, *Technical Project Planning (TPP) Process* and Interim Guidance Document 01-02, *Implementation of Technical Project Planning (TPP) For Ordnance and Explosives (OE) Formerly Used Defense Sites (FUDS) Projects*. The Contractor shall anticipate at least 2 meetings. One to be conducted in Waikoloa Village and one in the Waimea Town areas, to facilitate communication and the TPP process. As part of the TPP process, the Contractor shall develop a Conceptual Site Model (CSM) for Ordnance and Explosives Hazards that describes the site and its environment, based on existing knowledge.

**3.2 (TASK 2) DOCUMENTATION REVIEW AND SITE VISIT – (FFP)** The Contractor shall prepare and plan for a documentation review and site visit. The date of the visit must be coordinated at least 10 working days in advance with the Huntsville Project Manager. The Contractor shall review all pertinent project data and documentation to familiarize project staff with the project and identify any data gaps in planning a work approach for this project.

**3.2.2 Site Visit.** The Contractor shall plan, coordinate, and conduct a project site visit in conjunction with the first meeting for the TPP process. The site visit shall follow the procedures as outlined in EM 1110-1-4009 and EP 1110-1-18. Prior to the site visit, the contractor shall prepare an Abbreviated Site Safety and Health Plan (ASSHP) and submit the plan to the Contracting Officer for review and approval at least 10 days in advance of the site visit. The ASSHP has a brief, fill-in-the-blank format, and may be obtained from EP 1110-1-18, Appendix H. A planned approach shall be followed for the site visit to ensure all known data gaps are addressed, a full understanding of the complete site is obtained, and site coordination is established for site occupation. Before leaving the site, all parties involved in the site visit shall meet to ensure all data gaps are addressed and information and coordination has been accomplished. Upon completion of the site visit, the contractor shall prepare a detailed “After Action Report” detailing the events of the site visit and summarizing data gathered and the planned approach for

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the project execution. Some minimal additional work may be required for this EE/CA since two-phases of an EE/CA have occurred previously, and other removal action activities have occurred on the site.

**3.3 (TASK 3) – GEOPHYSICAL PROVE-OUT– (FFP)** Based on the DQOs developed during the TPP process, the Contractor shall seed the existing Geophysical Test Plots, to meet investigation criteria. There are 3 different test plots available at the Waikoloa Maneuver Area, based on the different types of geology and lava located on the Big Island. The Geophysical Prove-Out (GPO) will be accomplished in accordance with DID OE-005-05A.01 and will demonstrate the Contractor's geophysical capability. All requirements for the completion of this task shall be all inclusive. The location of the test plot, and certain Government blind seed items will have already been accomplished. The Contractor shall submit a "Draft" and "Final" version of the GPO Plan. Along with the GPO Plan, the Contractor shall also submit for approval a Site Safety and Health Plan (SSHP). The Contractor shall not begin field operations on the GPO plot until the government has approved the GPO Plan and SSHP. The Final GPO Plan shall be inserted in the Final EE/CA Work Plan as an appendix. The Contractor shall submit a Draft and Final GPO Letter Report in accordance with DID OE-005-05A.01, and shall insert the approved Final GPO Letter Report as an appendix to the Work Plan. A geophysical mapping team shall be established from personnel who have successfully demonstrated their ability by training on the prove-out plot for skill, ability, technique and procedure. The contractor's lead geophysicist for the project shall identify and document the composition of the project geophysical team and any changes to the team composition must document the proven skill, ability, and training of the new member. The lead geophysicist is responsible for the quality and performance of work from each member of the geophysical team.

**3.4 (TASK 4) - EE/CA WORK PLAN - (FFP)**. The Contractor shall prepare a detailed EE/CA Work Plan and sub-plans in accordance with (IAW) DID OE-001.01 and associated DIDs for the work on this project. The existing "Former Waikoloa Maneuver Area EE/CA Master Work Plan, and Phase II addendum dated March 2000, will be used as the starting point. Only revision or additions required for these specific sites will be required. The work plan shall include emergency contingencies for RCWM in the event that it is discovered during anomaly excavation. The registered Professional Engineer-In-Charge of the project shall sign all work plan submittals and seal the final work plan submittal. The registered Professional Engineer-In-Charge of the project shall be held directly responsible for the quality and completeness of the work plan submittals.

**3.5 (TASK 5) - LOCATION SURVEYS AND MAPPING – (FFP)** The Contractor shall perform topographic and location surveys as described in the approved Work Plan and in accordance with CEHNC guidance contained in EM 1110-1-4009 and DID OE-005-07.01, Location Survey and Mapping Plan. Aerial photography *is not* currently available from the Corps' Topographic Engineering Center (TEC). However, due to other activities at the site, a GIS base mapping system may be available for the Contractor to use

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and reference. A licensed Professional Land Surveyor in the State where the work is being performed shall certify all surveying requirements to include all control points, grid corners, transect points and boundaries as required by the project. The Northing and Easting (Y, X) for all control points, grid corners, transect points, and any boundaries or closures shall be presented in a certified letter or drawing, along with electronic submittal of the same to CEHNC upon completion of the field work. A minimum of 2 (two) control monuments shall be established or identified for this site. Survey data may be submitted by CD or electronically via email and must be compatible for the GIS database. The site grid and transect data shall include a map of the entire site with grids and transects shown and other pertinent features. A tabulated list shall be developed which identifies or numbers each grid and transect and gives the UTM coordinates of starting, ending, and turning points for transects and grid corners. The list shall also include all network reference points used in performing all surveys. The contractor shall furnish control cards for all benchmarks used during and established for the project. Points along each transect shall be marked at 200 feet intervals on the ground and shown on the base maps. Intervals of 50 feet or 100 feet shall be used for short legged transects. All grid corners and transect markers shall be marked with a wooden stake with flagging or an approved marking technique. Survey locations shall be listed in UTM coordinates and the data submitted in Microsoft Excel 2000 or other digital format approved by the CO. All survey data shall be included in the EE/CA Report and entered in the GIS database.

**3.5.1** Metadata to surveying information for OE items shall meet the requirements of the geophysical dig sheet and target history template provided in DID OE-005-05.01.

**3.6 (TASK 6) – ESTABLISHMENT AND MANAGEMENT OF GIS – (FFP)** The Contractor shall use the CEHNC OE GIS model, or other model approved by the CO, and apply it to this project. However, due to other activities at the site, a GIS base mapping system may be available for the Contractor to use and reference. The availability of this initial model will be driven by availability of funding and progression of work under a separate contract and delivery order. The model shall be used, as a starting point to load data and create a project-specific GIS tailored for the specific OE investigative needs of this site. Further guidance can be found in EM 1110-1-4009 and DID OE-005-14.01. Spatial data shall be in ArcView. Raster data shall be in TIF format. Tabular data shall be in ANSI SQL data base format as well as Access format. All changes from the model shall be fully documented into a manual specifically tailored for this project. The Contractor shall submit a CD with all GIS data and updates with the monthly report. The Contractor shall provide on a secure Website all project-related submittals and project correspondence. A password is required and shall be coordinated through CEHNC by the contractor. All data generated on this project shall be incorporated into a GIS database.

**3.7 (TASK 7) GROUND RECONNAISSANCE – (FFP)** The Contractor shall prepare a plan for conducting an instrument assisted Ground Reconnaissance (Recon) at the project site. The data

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gathered from this Recon will be used to determine where to conduct subsequent geophysical mapping and intrusive investigation. The Recon will be used to provide supporting data for the entire site and provide confirmation of assumptions made in the characterization of the site. The plan shall follow the general guidance as given in EP 1110-1-18. The plan shall describe the approach that the contractor will use to perform the Recon to obtain supporting information relating to OE. The Recon outline will propose areas to be checked (Sectors 15, 16, and 17), routes to be taken, procedures for looking for OE evidence, procedure for documenting findings or data, equipment to be used, and use of the data collected. Recon teams will generally be made of either 5-person or 7 person sweep teams. The Recon plan shall be included in the project Work Plan. During the Recon, the contractor shall use GPS and magnetometers to assist in gathering data and shall be prepared to deal with any OE found in accordance to the work plan procedures. All data and information obtained from the Recon shall be included in the GIS database. Assume for the purposes of this proposal that the Recon will provide 10 percent coverage of the total sector acreage.

**3.8 (TASK 8) BRUSH CLEARING**. Not used. See Task 9.

**3.9 (TASK 9) - GEOPHYSICAL MAPPING AND EVALUATION – (UNIT PRICE)** The Contractor shall implement geophysical mapping as described in the approved Work Plan and DID OE-005-05.01. The Contractor shall perform the minimum amount of work necessary to clear paths or areas of vegetation, which impede the progress, effectiveness or safety of the geophysical mapping team, or affect the data quality. All surface OE, OE scrap and other metallic scrap shall be collected, documented, and properly disposed of from the geophysical mapping paths or areas. The data from the surface clearance for the geophysical mapping process shall be entered into the GIS database and the final report. All OE-related activities shall be performed in accordance with applicable sections of the approved Work Plan. For planning, the contractor shall plan on mapping a minimum of 20 acres. The Contractor shall provide a total geophysical mapping cost and the associated unit price per acre. The Government reserves the right to increase or decrease the total investigated acreage. If geophysical mapping requirements vary by more than 10% of the acreage given in this SOW, the contract will be modified using the pre-negotiated unit price.

**3.9.1 Geophysical Mapping**. The final acreage that will be geophysically mapped for conventional OE investigation using a continuous hybrid system approach of modified transects and 100 x 100 foot grids is 20 acres, but may be re-evaluated through the TPP process. The number, size, and location of transects and grids may change based upon conditions encountered in the field and must be coordinated through a CEHNC representative. Once determined, the actual total acreage shall not increase or decrease without written approval from the Contracting Officer. The contractor shall ensure that the geophysical mapping

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data has continuous survey coverage using either GPS or standard survey procedures that meet the required accuracy.

**3.9.2 Evaluation.** After the geophysical prove-out requirements have been met and a digital geophysical mapping data collection method has been selected and approved, portions of the site will be geophysically mapped. The Contractor shall utilize the identified geophysical team to geophysically map the identified areas and the project geophysicist to analyze and evaluate the geophysical data collected. Raw and processed data shall be provided to CEHNC no later than **48 hours** after completion of **daily** geophysical mapping events. A letter signed by the project geophysicist shall accompany the data verifying the quality of the data. The geophysicist shall make a professional determination regarding the identification of target anomalies at the site that meet the established selection criteria. Based on this determination, the Contractor shall provide to the Government dig-sheets in accordance with Appendix B. The project geophysicist shall continually compare predicted results with actual results so that the Contractor's geophysical evaluation methodology is constantly refined over the life of the project.

**3.9.3 Anomaly Selection.** The Contractor shall document the methodology and criteria for the selection of target anomalies in the approved Work Plan based upon criteria and data quality objectives agreed upon by the project team. All anomalies that meet the pre-established target anomaly selection criteria will be identified for excavation. Refinement of the selection process shall be a continuous process. The dig sheet shall also identify the contractor's QC target anomalies as described in the QC plan. The Government will select five anomalies/acre to be excavated by the contractor for quality assurance.

**3.10 (TASK 10) - ANOMALY REACQUISITION AND MARKING (UNIT PRICE)** The Contractor shall reacquire all selected geophysical target anomalies identified on the dig sheets and utilize precision surveying method to identify the location. The Contractor shall mark the actual field location of each identified anomaly shown on the dig sheet with a non-metallic pin flag or by some other method approved by CEHNC. During excavation, the Contractor shall record and report all data to include the original mapped locations (way-pointing) of anomalies as shown on the dig-sheet, and actual locations of the reacquired anomaly excavated. Any such reporting shall include distance and orientation from grid north. The Contractor shall also report any anomalies that could not be reacquired. The Contractor shall provide a total anomaly reacquisition cost based upon 160 anomalies/acre and a unit cost based on burn-rate per anomaly. If the actual number varies by more than 10 percent of the total anomalies identified for reacquisition, the contract will be modified using the pre-negotiated unit price.

**3.11 (TASK 11) – INTRUSIVE INVESTIGATIONS (OE SAMPLING) – (UNIT PRICE)** The Contractor shall, utilizing UXO qualified personnel as outlined in DID OE-025.01, implement site OE intrusive sampling as specified in the approved Work Plan, and facilitate OE destruction and OE scrap removal

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from the site. This task shall be accomplished according to approved Work Plan procedures. For planning purposes, the Contractor shall assume 160 excavation/acre and provide a unit cost based on burn-rate per excavation. If the actual number varies by more than 10 percent, or 320 anomalies (160 x 20 acres x 10%), the contract will be modified using the pre-negotiated unit price.

**3.11.1 INTRUSIVE ANOMALY INVESTIGATION (Geophysically Mapped Areas)** The Contractor shall provide all necessary qualified personnel and equipment to perform intrusive target anomaly investigation. The Contractor shall investigate target anomalies identified and re-acquired during the geophysical investigation and as directed by the Contracting Officer. The UXO personnel shall investigate the specified target anomalies according to approved Work Plan procedures. Based upon the geophysical mapping, the contractor shall investigate all anomalies identified from the geophysical dig sheet to include everything within a one-meter radius circle on transect targets and a one-meter diameter circle on grid targets. All surface OE, OE scrap, and metal over the entire transect route shall be collected and disposed of. Scrap shall be listed in the database as number of pieces per 100 foot section of transect or per grid along with the description and a digital picture. The data from the intrusive investigation as well as the surface clearance shall be entered in the GIS database and the final report. A digital photograph of each item from the intrusive investigation shall be taken and entered into the GIS database as well as any live item found on any investigation.

**3.11.2 INTRUSIVE ANOMALY INVESTIGATION (Mag and Flag Operations)** The Contractor shall provide all necessary qualified personnel and equipment to perform intrusive investigation. The Contractor shall investigate anomalies identified during the geophysical investigation operation. The UXO personnel shall investigate the specified target anomalies according to approved Work Plan procedures. For transects, the contractor will dig all anomalies within the first ten feet of each 100 foot section of transect. If no anomalies are identified within the first ten feet of transect, the contractor will continue searching along the transect and dig at least three anomalies if available within each 100 foot section of transect. For grids, the contractor shall dig all anomalies identified within the grid based upon a 100 x 100 grid. Following a planned approach as detailed in the work plan, the contractor shall maintain an accurate record and document what portion or area of a grid was cleared when the maximum number of excavated subsurface anomalies was reached. All surface OE, OE scrap, and metal shall be collected and disposed of from all transect routes or from all grids. Surface scrap shall be listed in the database as number of pieces per 100 foot section of transect or per grid along with the description and a digital picture of the total mass of collected scrap from each section or grid. The data from the intrusive investigation as well as the surface clearance shall be entered in the GIS database and the final report. A digital photograph of each item from the intrusive investigation shall be taken and entered into the GIS database as well as any live item found on any investigation.

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**3.11.3 OE DESTRUCTION.** The Contractor shall be responsible for destroying all OE encountered during site investigations. The Contractor shall establish the method of destruction in the project Work Plan, and all OE destruction activities shall be in accordance with the Work Plan.

**3.11.4 BACKFILLING EXCAVATIONS.** All access/excavation/detonation holes shall be backfilled by the Contractor. The Contractor shall restore such areas to their prior condition.

**3.11.5 OE AND SCRAP ACCOUNTABILITY AND ANOMALY COUNT.** The Contractor shall maintain a detailed accounting of all OE items encountered and excavations performed. This accounting shall include the standard official nomenclature, condition of the item, depth located, orientation of item, location coordinates, and disposition of each OE item as well as description of each item found during every intrusive excavation. A digital photograph of each OE item as well as each item recovered from the intrusive investigation shall be taken and entered into the GIS database. The Contractor shall maintain a database of all OE item, all anomalies excavated, and surface OE scrap for the entire project.

In addition, the Contractor shall maintain a record of the number of pieces of OE scrap collected in each 100 foot section of transect or 100 x 100 grid and description of the scrap for the database. A digital photograph shall be taken of each stockpile of OE scrap/range residue for each grid or transect section and be entered into the database. The total weight shall be documented from the OE scrap turn-in procedure and documented in the final report.

**3.11.6 FINAL DISPOSITION OF AEDA RESIDUE, RANGE RESIDUE, OE SCRAP AND/OR EXPLOSIVE CONTAMINATED PROPERTY.(FFP)** The Contractor shall furnish all necessary personnel and equipment to make final disposition of all recovered OE scrap and Ammunition, Explosives, and Dangerous Articles (AEDA) and Range Residue. The methodology to accomplish this task shall be proposed in the WP and shall be in accordance with Attachment 1.

**3.12 (TASK 12) DATA ASSESSMENT (FFP)** . The Contractor shall perform regular data assessments of the intrusive sampling and site Recon to determine any data gaps or potential data gaps and correct the deficiencies immediately. Prior to demobilization from the site and prior to completion of the fieldwork, the Contractor shall schedule one last data assessment discussion with CEHNC to ensure no data gaps exist. If data gaps are discovered, the Contractor shall notify the CEHNC project manager of the data gaps or potential data gaps and coordinate a work effort to fill the data gaps before leaving the site.

**3.13 (TASK 13) – ENVIRONMENTAL SAMPLING AND CHEMICAL ANALYSIS. Not Used.**

**3.14 (TASK 14) - PREPARE EE/CA REPORT – (FFP).** The Contractor shall prepare and submit an EE/CA report in accordance with DID OE-010.01. The EE/CA Report will actually be a revision or addendum to the Phase II EE/CA Report, prepared by Earth Tech, Inc., and dated January 2002. The textual portions of the report shall be fully supported with accompanying maps, charts, and tables, and

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data as necessary for the standard format. The report shall characterize the nature, location and concentration of OE at the project site. The report shall describe OE-related problems that affect the current and future use of the site, and shall identify, develop, and analyze various risk management alternatives and cost, including institutional controls. The EE/CA Report shall note any changes to the site or recommendations that are presented in the Phase II Report.

**3.14.1 SITE CHARACTERIZATION DATA REPORT** The contractor shall assemble all the detailed project information and support data for EE/CA Report as a separate Site Characterization Data Report document. Data shall include all detailed OE sampling data, surveying data, mapping data of each grid or transect in color, OE data, and any other supporting characterization data. The data shall fully detail the site characterization for both OE and any environmental characterization that was performed in support of the OE characterization. All data will be cross-referenced in the GIS database and the Conceptual Site Model. This data shall provide the detailed support documentation for the EE/CA report.

**3.14.2 ORDNANCE AND EXPLOSIVE RISK ASSESSMENT REPORT**. The contractor shall prepare an Ordnance and Explosives Risk Assessment Report. During the TPP process, a risk methodology shall be selected for use in assessing the risks associated with OE. The results of the risk assessment shall be included as input in evaluating the effectiveness criteria during the analysis of response alternatives. For guidance on risk characterization and analysis, refer to EM 1110-1-4009 and Interim Guidance Document 01-01, "OE Risk Impact Analysis for OE EE/CA Evaluations".

**3.14.3 INSTITUTIONAL ANALYSIS AND INSTITUTIONAL CONTROLS PLAN**. The Contractor shall perform an institutional analysis in accordance with EP 1110-1-24 and develop an Institutional Analysis Report and an Institutional Controls Plan in accordance with DID OE-100.01. The analysis and report will be included in the EE/CA Report as an appendix and shall describe the mechanisms to protect property owners and the public from hazards contained on the site by limiting the access or use of the property, or by warning of the hazard. The Institutional Controls Plan shall be included as Chapter 7 of the EE/CA report.

**3.14.4 RECURRING REVIEW PLAN**. The Contractor shall prepare a draft Recurring Review Plan in accordance with DID OE-110.01 to be included in the EE/CA report as an appendix. The plan shall be developed in accordance with EP 1110-1-24 and consistent with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and the National Oil and Hazardous Substance Pollution Contingency Plan. The purpose of the Recurring Review is to monitor the effectiveness of all elements of the implemented project. Recurring Reviews also provide an opportunity to respond to problems that develop over the life of the project.

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**3.15 (TASK 15) – PREPARE ACTION MEMORANDUM – (FFP).** After the EE/CA report has been finalized, public input completed, and the EE/CA process completed, the Contractor shall prepare a Revised Action Memorandum in accordance with EP 1110-1-18 guidance document. This shall be a revision to the existing Action Memorandum for Waikoloa Maneuver Area.

**3.16 (TASK 16) COMMUNITY RELATIONS PLAN (CRP). Not Used.**

**3.17 (TASK 17) – COMMUNITY RELATIONS SUPPORT – (FFP)** The contractor shall be prepared to provide an individual to support the community relations effort during the project life. This individual will assist in organizing local community support and perform duties as directed to accomplish project requirements and objectives. The Contractor shall also attend and participate in at least 3 public meetings and one CEHNC meeting as directed by the Contracting Officer. The support shall include preparation and delivery of briefings, graphics and presentations, participation in site visits and the TPP process, and development of information or educational packets to inform the public. The public meetings will be held at a site that is most convenient for most of the attendees. One additional independent meeting will be held at CEHNC at which the Contractor will present his findings of the characterization effort/field work along with his plan for developing the EE/CA report. This meeting will occur prior to the Contractor demobilizing from the project site and prior to EE/CA report being published in draft form. The contractor shall provide a unit cost per meeting. Total cost shall be based on at least 4 meetings to include the final EE/CA briefing to the public and stakeholders and the CEHNC meeting.

**3.18 (TASK 18) – PROJECT MANAGEMENT – (FFP)** The Contractor shall develop a project management plan and perform strict project management functions as necessary to maintain project control and to meet required reporting requirements. Project control includes managing the project schedule, budget, and quality of all aspects of the project. All schedules shall be developed and submitted in “Microsoft Project” format. A base schedule shall be developed for the entire life of the project with each phase of the project represented as a milestone and project milestones located within each phase. A base budget will be developed in association with the base schedule. An actual schedule and budget will be maintained by the contractor and tracked against the base schedule and budget. Variations between the two shall be reported in the monthly report. Poor or inadequate project management resulting in poor quality in work products and over-runs in schedule or budget will result in corrective action by the Contracting Officer and will be reflected in the Contractor’s evaluation.

**3.19 (TASK 19) HISTORICAL/ARCHAEOLOGICAL SURVEY. Not Used.**

**3.20 (TASK 20) ENVIRONMENTAL SURVEY. Not Used.**

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**3.21 (TASK 21) ADMINISTRATIVE RECORD. Not Used.****3.22 (TASK 22) PROJECT DOCUMENTATION. Not Used.****4.0 SUBMITTALS AND CORRESPONDENCE.**

**4.1 FORMAT AND CONTENT OF EE/CA REPORTS.** The Contractor shall prepare a detailed EE/CA report as outlined in DID OE-010.01. Even though draft report and final report submittals are requested, the term "draft" shall not reflect upon the quality of the report being submitted by the Contractor. The Contractor shall perform an overall review of each document prior to its' submittal and check for proper data, figure and table references, proper format, grammatical and spelling errors, and quality of the product in general. Deficiencies, ambiguities, conflicts, and inconsistencies shall be corrected prior to the submittal of the draft document. Engineering Reports presenting all data, analyses, and recommendations shall be prepared and submitted by the Contractor and shall be a direct reflection of the workmanship of the corporation and the quality control process. Each report shall identify the specific members and title of the Contractor's staff, all registered professionals with registration numbers, and subcontractors that had significant, specific input into the reports' preparation or review. A Quality Manager in the upper structure of the corporation will sign all draft and final documents to ensure corporate acceptance of the quality of the report. The registered Professional Engineer-In-Charge of the project shall seal the final reports.

**4.2 COMPUTER FILES.** All text files generated by the Contractor under this contract shall be furnished to the Contracting Officer in Word 6.0/95 or higher software, IBM PC compatible format. This format shall facilitate the development of hypertext markup language (HTML) or PDF deliverables required in the following paragraph. All laboratory data for samples analyzed by commercial laboratories shall be submitted in the Automated Data Review software electronic data deliverable (EDD) format. Tables A1 and A3 are mandatory submittals. Table A2 should be provided if the laboratory is capable. All final CADD/GIS data, design drawings and survey data generated by the Contractor under this delivery order shall be submitted in the proper format and media that will permit their loading, storage, and use without modification or additional software on the Huntsville Center CADD/GIS workstations.

**4.3 HTML or PDF DELIVERABLES.** All submittals identified in this SOW and especially the final version of the EE/CA Report, the Action Memorandum, Site Characterization Data Report and all individual report documents shall be submitted, uncompressed, on individual CD ROM in HTML or PDF along with a linked table of contents, linked tables, linked photographs, linked graphs and linked figures included and suitable for viewing on the Internet.

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**4.4 REVIEW COMMENTS.** Various reviewers will have the opportunity to review submittals made by the Contractor under this contract. The Contractor shall review all comments received from the Contracting Officer and evaluate their appropriateness based upon their merit and the requirements of the SOW. The Contractor shall issue to the Contracting Officer a formal, annotated response to each comment in accordance with the schedule in paragraph 4.14.

**4.5 DRAFT REPORTS.** Each page of draft reports shall be stamped "DRAFT". Submittals that have been reviewed shall include incorporation and notation of all previous review comments accepted by the Contractor. Draft reports shall be a quality product and draft only in finalization of data.

**4.6 MINUTES OF MEETINGS.** The Contractor shall prepare and submit minutes of all meetings attended to the Contracting Officer within 10 calendar days.

**4.7 CORRESPONDENCE.** The Contractor shall keep a record of each phone conversation and written correspondence affecting decisions relating to the performance of this Task Order. A summary of the phone conversations, e-mails, and written correspondence shall be submitted with the monthly Project Status Report.

**4.8 PROJECT CONTROL AND REPORTING.** The Contractor shall prepare and submit a Work, Data, and Cost Management Plan IAW DID OE-005-08.01. The plan shall be included as part of Chapter 2 of the Work Plan.

**4.9 PROJECT STATUS REPORT** A project status report shall be submitted in accordance with DID OE-085. A deficiency report will be included in the weekly report, which list all deficiencies in work products or procedures and describes what action has been taken to correct the process and documented in a Corrective Action Report (CAR). This will include surveying, geophysical mapping, geophysical analysis, reacquisition, and QC and QA failures. Failure to report critical issues to the Government in a timely manner that impact the project will result in corrective action from the Contracting officer.

**4.10 MONTHLY PROGRESS REPORT AND DATA SUBMITTALS.** Not used.

**4.11 DAILY QC REPORTS FOR ENVIRONMENTAL SAMPLING.** Not Used.

**4.12 PUBLIC AFFAIRS.** The Contractor shall not make available or publicly disclose any project data or reports generated or reviewed under this contract or any subcontract unless specifically authorized by the Contracting Officer, the Public Affairs Office (PAO) of the U. S. Army Engineer District, and/or the OE Design Center PAO. When approached by any person or entity requesting information about the subject

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of this contract, the Contractor shall defer to the PAO for response. Reports and data generated under this contract shall become the property of the Government and distribution to any other source by the Contractor is prohibited unless authorized by the Contracting Officer.

**4.12 ADDRESSES.** The following addresses shall be used in mailing submittals:

**A.**

Commander  
US Army Engineering and Support Center, Huntsville  
ATTN: CEHNC-OE-DC (Mr. Robert V. Nore)  
4820 University Square  
Huntsville, AL, 35807-4301

**B.**

Commander  
US Army Engineering and Support Center, Huntsville  
ATTN: CEHNC-CT-C (Ms Lydia Tadesse)  
4820 University Square  
Huntsville, AL, 35807-4301

**C.**

Commander  
US Army Corps of Engineers, Honolulu District  
ATTN: CEPOH-PM (Ms. Helene Takemoto)  
Bldg. 230  
Fort Shafter, HI 96858-5440

**4.14 SCHEDULE AND SUBMITTALS.** The Contractor shall submit all deliverable data to the Contracting Officer and other reviewers shown in Paragraph 4.13 in accordance with the following schedule. All submittals shall be delivered to all addressees no later than the close of business on the day indicated in this paragraph.

	<b>DELIVERABLES</b>	<b>DATE DUE</b>
1.	Kickoff Meeting/Site Visit	TBD
2.	<b>ASSHP</b>	10 work days prior to site visit.
3.	<b>Baseline Schedule</b>	7 work days after kickoff meeting
4.	<b>Draft Geophysical Test Plot Plan</b>	14 work days after kickoff meeting
5.	<b>Final Geophysical Test Plot Plan</b>	7 work days after comments received
6.	<b>GPO letter report</b>	According to project schedule
7.	<b>Draft EE/CA Work Plan</b>	60 days after award of TO
8.	Contractor Receive WP Comments from HNC.	45 days after submittal is received
9.	<b>Draft Final Work Plans</b>	20 days after return of comments
10.	Contractor Receive WP Comments from Govt.	30 days after submittal is received
11.	<b>Final EE/CA Work Plan</b>	10 days after return of comments
12.	Community Relations meetings	According to project schedule
13.	TPP meetings	TBD
14.	<b>Community Relations Plan</b>	According to project schedule
15.	<b>Conceptual Site Model</b>	First TPP meeting
16.	CEHNC Meeting	Prior to demobilization
17.	<b>Draft EE/CA Report &amp; Sub-Reports</b>	8 wks after completion of field work
18.	Contractor Receive Comments from CORPS.	4 weeks after submittal received
19.	Draft Final EE/CA Reports & Site Data Report	4 weeks after comments received
20.	Contractor Receive Comments	4 weeks after submittal received
21.	<b>Final EE/CA Report &amp; Response Summary</b>	4 weeks after comments received
22.	Public Meeting EE/CA report presentation	According to project schedule
23.	<b>Draft Action Memorandum</b>	According to project schedule
24.	<b>Final Action Memorandum</b>	According to project schedule
25.	<b>Weekly Report</b>	First day of following week
26.	<b>Monthly Report</b>	NLT 10th of following month
27.	<b>Minutes of Meetings</b>	NLT 10 days after each Meeting
28.	<b>Daily Quality Control Report for Environmental Sampling</b>	Daily during Environmental Sampling Activities
29.	<b>Analytical Data Submittal for QA Evaluation</b>	30 days after completion of environmental sampling activities
30.	<b>Electronic Laboratory Data Submittal</b>	30 days after completion of environmental sampling activities
31.	<b>Overall completion date</b>	According to project schedule

**4.15 Submittal Quantities.** The numbers of submittals to be provided for the addressees in section 4.13 are shown below.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A.		2	2	2	3	3	5		5		5			3
B.		1	1		1	1			1		1			
C.		2	2	2	3	3	3		3		3			3

	15	16	17	18	19	20	21	22	23	24	25	26	27	28
A.	3		5		5		5	2	5	5	2	2	2	2
B.							1		1	1	1	1	1	1
C.	3		3		3		3	2	3	3	2	2	2	2

	29	30	31											
A.	2	2	2											
B.	1	1	1											
C.	2	2	2											

**5.0 SAFETY AND HEALTH PROGRAM.** The SSHP shall be prepared in accordance with DID OE-005-06.01, and submitted with the Work Plan for approval. On-site activities shall not commence until the plan has been reviewed and accepted.

**6.0 PERFORMANCE METRICS.** (See Section C – Paragraph 6.0 of the Basic Current Contract). The performance and subsequently the evaluation of the contractor shall be based on certain performance metrics. The metrics include safety, quality, schedule, cost, and customer satisfaction. Evaluation will normally be performed at least on a per Task Order basis and annually. Appraisals will be issued to support exercising subsequent option periods using AFARS 42.15 and ER 715-1-19. The Contractor will be allowed to provide input to specific performance metrics on a Task Order basis. However, the government will make the final determination of specific performance metrics. The performance metrics are listed in Section C – Paragraph 6.0 of the basic contract.

**7.0 QUALITY ASSURANCE.** In association with the Contractor's QC process as outlined in his detailed QC plan, the Government shall perform Quality Assurance (QA) and spot checks on all phases and types of work done on the project to ensure safety, quality workmanship, proper procedures, and quality products. Safety violations, poor workmanship, failure to follow proper procedures, inferior work products and documents, or work products that do not meet required accuracy and is discovered by the

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Government will be QA failures. Any work or process that fails the Government QA process shall be re-done by the Contractor at no cost to the Government and full documentation given to correct the problem. In order to evaluate the effectiveness of the geophysical investigation and evaluation methods utilized by the Contractor, the Contracting Officer may provide an independent contractor or may provide Government personnel to independently map, evaluate, locate and access some detected subsurface anomalies as deemed necessary or mark and flag portions of the contractor work areas to be intrusively investigated. Any item that is found during QA procedures that meets the established target criteria will be a QA failure. During reacquisition, QA failure will be if the target item is not found within a one-meter radius of the dig sheet coordinates. The Government will prepare a QA Report to be part of the permanent record to document the Quality Assurance process and the contractor's performance and quality of work on the project.

**8.0 REFERENCES.** (See Section C – Paragraph 8.0 of the Basic Current Contract for common references). References used in the development of this Scope of Work (SOW) are list in Section C – Paragraph 8.0 of the basic contract as well as the ones listed below:

**8.1** Federal Acquisition Regulation, F.A.R. Clause 52.236-13: Accident Prevention.

**8.2 OE DIDs** Note that unless specified otherwise, the Contractor shall use the edition of the DIDs current at the time of contract award.

- DID OE-001.01 EE/CA Work Plan
- DID OE-005-02.01 Technical Management Plan
- DID OE-005-03.01 Explosives Management Plan
- DID OE-005-04.01 Explosives Siting Plan
- DID OE-005-05.01 Geophysical Investigation Plan
- DID OE-005-06.01 Site Safety and Health Plan
- DID OE-005-07.01 Location Surveys and Mapping Plan
- DID OE-005-08.01 Work, Data, and Cost Management Plan
- DID OE-005-11.01 Quality Control Plan
- DID OE-005-12.01 Environmental Protection Plan
- DID OE-005-14.01 Geographic Information System
- DID OE-010.01 Engineering Evaluation/Cost Analysis (EE/CA) Report
- DID OE-015.01 Accident reports
- DID OE-025.01 Personnel and Work Standards
- DID OE-030.01 Site Specific Final Report
- DID OE-045.01 Report /Minutes, Record of Meetings
- DID OE-054.01 Geophysical Prove-out (GPO) Plan and Report

DID OE-055.01 Telephone Conversations/Correspondence Records

DID OE-085.01 Project Status Report

DID OE-100.01 Institutional Analysis and Institutional Control Plan

DID OE-110.01 Recurring Review Plan

### 8.3 Archives Search Report

8.4 EM 200-1-2, *Technical Project Planning (TPP) Process*, 31 Aug 1998

8.5 EM 200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans*, 01 February 2001

8.6 EPA 540-R-92-021, *Guidance for Performing Site Inspections Under CERCLA*, September 1992

8.7 *Test Methods for Evaluating Solid Wastes*, U.S. Environmental Protection Agency (USEPA) Pub. No. SW- 846, Latest promulgated Ed.

8.8 ER 1110-1-263, *U.S. Army Corps of Engineers Chemical Data Quality Management for Hazardous, Toxic, Radioactive Waste Remedial Activities*, 30 April 1998.

8.9 ERDC TR-01-13, *Distribution and Fate of Energetics on DoD Test and Training Ranges: Interim Report 1*, September 2001.

### **9.0 GOVERNMENT FURNISHED.**

9.1 Available GIS and maps describing the site. Available pertinent UXO technical publications/information that may be required. All DIDs referenced within this scope of work can be found at [www.hnd.usace.army.mil/oew/policy/dids/didindx.html](http://www.hnd.usace.army.mil/oew/policy/dids/didindx.html). The Right-of-Entry approval forms from all the applicable property owners.

9.2 ADR software to be provided by USACE via Laboratory Data Consultants. Environmental Data Management System (EDMS) software available from USACE via Laboratory Data Consultants (use is optional). Forms II Lite software available from USACE via US Environmental Protection Agency (use is optional).

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**ATTACHMENT 1****CEHNC-OE****6 August 2001****Corps of Engineers Contractors Ordnance and Explosive (OE), Range Residue (RR) Inspection, Certification, and Final Disposition Procedures****I. OE, RR Inspection – Contractor Responsibilities and Procedures**

- The U.S. Army Corps of Engineers (USACE) contractors executing projects will comply with the following procedures for processing OE and Range Residue for final disposition as scrap metal. The objective of these procedures is to ensure that an inspection procedure of the exterior and interior surfaces of all recovered items is in place to ensure these items do not present an explosive hazard. These USACE contractor responsibilities and procedures will be contained in the project work plan.
  - Unexploded Ordnance (UXO) Sweep Personnel will only mark suspected items and will not be allowed to perform any assessment of a suspect item to determine its status.
  - Unexploded Ordnance (UXO) Tech I will only tentatively identify a located item as scrap or OE.
  - UXO Technician II will:
    - Inspect each item as it is recovered and determine the following:
      - Is the item a UXO or a component of a military munition?
      - Does the item contain explosives or other dangerous materials?
      - Does the item require detonation?
      - Does the item require demilitarization (demil) or venting to expose internal fillers?
    - Segregate items requiring demil or venting procedures from those items ready for certification.
    - Items found to contain dangerous fillers will be process in accordance with applicable procedures.
      - UXO Technician III will:
        - Inspect recovered items to determine if free of dangerous fillers.
        - Supervise detonation of items found to contain dangerous fillers and venting/demil procedures.
        - Supervise the consolidation of recovered scrap metal for containerization and sealing.
          - UXO Quality Control (QC) Specialist will:

- 
- Conduct daily audits of the procedures used by UXO teams and individuals or processing OE or Range Residue.
  - Perform and document, a minimum of 10% random sampling of all scrap metal collected from the various teams to ensure no items of a dangerous or explosives nature are identified as scrap metal.
  - Perform these random checks to satisfy that OE or range residue is free from any explosive hazards, necessary for completion of the Requisition and Turn-in Document, DD Form 1348-1A.
- f. UXO Site Safety Officer (UXOSO) will:
- 1. Ensure the specific procedures and responsibilities for processing OE and Range Residue for certification as scrap metal are being followed, performed safely, consistent with applicable regulations, and in accordance with the USACE approved project work plan.
    2. Will perform random checks of processed OE and Range Residue to ensure Items being identified as scrap are free from any explosive hazards.
- g. Senior UXO Supervisor will:
- Be responsible for ensuring work and Quality Control (QC) Plans specify the procedures and responsibilities for processing OE and Range Residue for the final disposition as scrap metal.
  - Ensure a Requisition and Turn-in Document, DD Form 1348-1A is completed for all scrap metal to be transferred for final disposition.
  - Perform random checks to satisfy that the OE or range residue is free from explosive hazards, necessary to complete the DD 1348-1A.
  - Certify all scrap metal generated from OE or Range Residue as free of Explosive hazards.
  - Be responsible for ensuring that these inspected materials are secured in a closed, labeled and sealed container and documented as follows;
- The container will be closed and clearly labeled on the outside with the following information: The first container will be labeled with a unique identification that will start with **USACE/Installation Name/Contractor's Name/0001/Seal's unique identification** and continue sequentially.
  - The container will be closed in such a manner that a seal must be broken in order to open the container. A seal will bear the same unique identification as the container or the container will be clearly marked with the seal's identification if different that the container.
  - A documented description of the container will be provide by the contractor with the following information for each container; contents, weight of container; location where OE scrap was obtained;

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name of contractor, names of certifying and verifying individuals; unique container identification; and seal identification, if required (see paragraph I. 1.g. (5)). These documents will also be provided by the contractor in a separate section of the final report.

## II. OE Scrap Certification and Verification

➤ The contractor will ensure that scrap metal generated from OE or Range Clearance is properly inspected in accordance with the procedures in I. above. Only personnel who are qualified UXO personnel per USACE's Contract Data Item Description (DID) OE-025.01 will perform these inspections. The Senior UXO Supervisor will certify and the USACE's OE Safety Specialist will verify that the scrap metal is free of explosive hazards.

1. DD form 1348-1A will be used as certification/verification documentation. All DD 1348-1A must clearly show the typed or printed names of the contractor's Senior UXO Supervisor and the USACE's OE Safety Specialist, organization, signature, and contractor's home office and field office phone number(s) of the persons certifying and verifying the scrap metal.

a. Local directives and agreements may supplement these procedures. Coordination with the local concerns will identify any desired or requested supplementation to these procedures.

b. In addition to the data elements required and any locally agreed to directives, the DD 1348-1A must clearly indicate the following for scrap metal:

6 Basic material content (Type of metal; e.g., steel or mixed)

7 Estimated weight

8 Unique identification of each of the containers and seals stated as being turned over.

9 Location where OE scrap was obtained.

10 Seal identification, if different from the unique identification of the sealed container.

- The following certification/verification will be entered on each DD 1348-1A for turn over of scrap and will be signed by the Senior UXO Supervisor and the USACE OE Safety Specialist.

**"This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards."**

## III. Maintaining The Chain Of Custody And Final Disposition

1. The contractor in coordination with the Corps of Engineers, will arrange for maintaining the chain of custody and final disposition of the certified and verified material. The certified and verified material will only be released to an organization that will:

- Upon receiving the unopened labeled containers each with its unique identified and unbroken seal ensuring a continued chained of custody, and after reviewing and concurring with all the provided supporting documentation, sign for having received and agreeing with the provided documentation that the sealed containers contained no explosive hazards when received. This will be signed on company letterhead and stating that the contents of these sealed containers will not be sold, traded or otherwise given to another party until the contents have been smelted and are only identifiable by their basic content.

- Send notification and supporting documentation to the sealed container-generating contractor that the seal containers have been smelted and are now only identifiable by their basic content.

- This document will be incorporated by the contractor into the final report as documentation for supporting the final disposition of this scrap metal.



**APPENDIX B      SITE MAP**





Harbor



Water Tower with Tank Trail



Terrain in Sector 16



Puukohola Heiau Historic Site



Hapuna Bay



HAPUNA BEACH STATE PARK



THELMA PARKER MEMORIAL COMMUNITY SCHOOL LIBRARY BUILDING



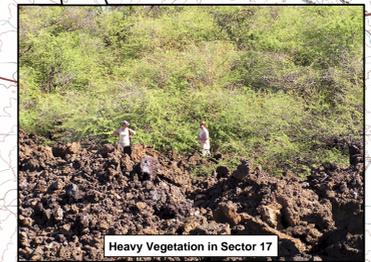
Terrain in Sector 17



Terrain in Sector 15



Terrain in Sector 15



Heavy Vegetation in Sector 17

Sector 16  
150 Acres

Sector 15  
264 Acres

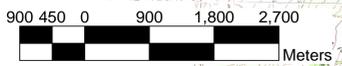
Sector 17  
250 Acres

**Legend**

- Roads Driven
- EE/CA Areas

**Ground Recon Survey Type**

- Field Reconnaissance Transects
- Transects Where Terrain Permits
- Excluded Developed Areas
- Limited By Terrain (Lava Flow)
- Meandering Path Where Vegetation Permits
- Ground Recon Boundaries



**NOTE:**  
EE/CA Boundaries should be considered as approximate as they were digitized from a hard copy map then georeferenced.

Waikoloa Phase III EE/CA  
**Figure B-1**  
Site Map with Ground Reconnaissance Plan

**USA Environmental, Inc.**





# Sector 16

# Sector 15

# Sector 17

1 200x200  
Foot Grid

3 200x200  
Foot Grids

Geophysical Transects are 3 feet wide (0.9144 meters).  
Grids are 200 x 200 feet (60.96 x 60.96 meters).

### Legend

-  Roads Driven
-  Geo Survey Transects & Grids
-  Ground Recon Boundaries
-  EE/CA Areas



**NOTE:**  
EE/CA Boundaries should be considered as approximate as they were digitized from a hard copy map then georeferenced.

Waikoloa Phase III EE/CA

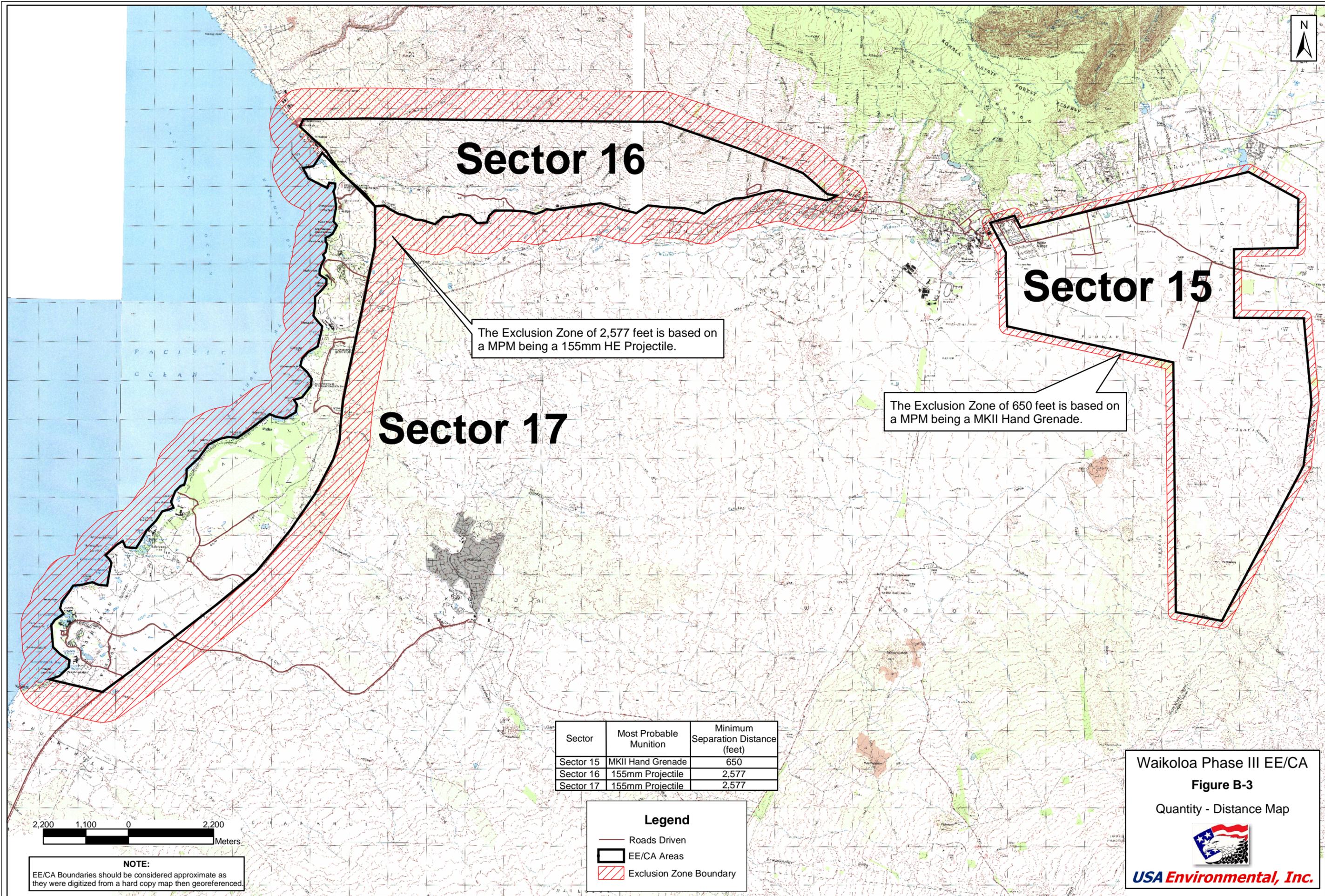
**Figure B-2**

Site Map with  
Idealized Geophysical  
Survey Plan



**USA Environmental, Inc.**





**Sector 16**

**Sector 15**

**Sector 17**

The Exclusion Zone of 2,577 feet is based on a MPM being a 155mm HE Projectile.

The Exclusion Zone of 650 feet is based on a MPM being a MKII Hand Grenade.

Sector	Most Probable Munition	Minimum Separation Distance (feet)
Sector 15	MKII Hand Grenade	650
Sector 16	155mm Projectile	2,577
Sector 17	155mm Projectile	2,577

**Legend**

-  Roads Driven
-  EE/CA Areas
-  Exclusion Zone Boundary



**NOTE:**  
EE/CA Boundaries should be considered approximate as they were digitized from a hard copy map then georeferenced.

Waikoloa Phase III EE/CA  
**Figure B-3**  
Quantity - Distance Map



**USA Environmental, Inc.**



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**APPENDIX C LOCAL POINTS OF CONTACT****C.1 Waikoloa Resource Advisory Board (RAB)**

Clayton Sugimoto  
Planner  
Wil Chee – Planning, Inc.  
1400 Rycroft Street, Suite 928  
Honolulu, Hawaii 96814  
(808) 955-6088

**C.2 Parker Ranch**

Parker Ranch Headquarters  
67-1435 Mamalahoa Highway  
Kamuela, Hawaii 96743  
(808) 885-7311

**C.3 USACE Honolulu District**

Charles F. Streck, Jr.  
Senior Program & Project Manager  
Building 230, Room 306  
ATTN: CEPOH-PP-E  
Fort Shafter, Hawaii 96858-5440  
(808) 438-6934

**C.4 Local Police**

Kamuela Police Station  
(808) 887-3080

Police Chief Lawrence K. Mahuna  
Hawaii County Police Department  
349 Kapiolani Street  
Hilo, Hawaii 96720  
Admin: (808) 935-3311  
Chief: (808) 961-2243

**C.5 FAA**

USFAA – Kailua Kona  
73-400 Kupipi Street  
Kailua Kona, Hawaii 96740  
(808) 329-3702

USFAA – Hilo  
PO Box 4909  
Hilo, Hawaii 96720  
(808) 935-4658

**C.6 Emergency Contact**

Police, Fire, Emergency Medical Service (EMS)  
911

**C.7 ATI Waikoloa**

James VanHuss  
65-1188 Mamalahoa Highway  
Suite 4  
Kamuela, Hawaii 96743  
(808) 885-3435

**C.8 Donaldson Enterprises**

Eric Brundage  
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Kaneohe, Hawaii 96744-3240  
(808) 235-2662

SITE SAFETY AND HEALTH PLAN  
WIAKOLOA MANEUVER AREA, KAMUELA,  
ISLAND of HAWAII, HAWAII

REVIEWS AND APPROVALS

Mr. Douglas D. Ralston  
Project Manager  
USA Environmental, Inc.  
(813) 884-5722



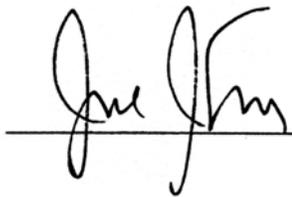
Date: 8 Dec 2003

Mr. Robert D. Crownover  
Safety and Health Manager  
USA Environmental, Inc.  
(813) 884-5722



Date: 29 July 2003

Mr. Jose J. Sosa,  
Certified Industrial Hygienist  
J.J. Sosa and Associates, Inc.  
5811 Memorial Hwy., Suite 207  
Tampa, FL. 33615-5000  
(813) 888-6525



Date: 7 August, 2003



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## D APPENDIX SITE SAFETY AND HEALTH PLAN

### D.1 INTRODUCTION

This Site Specific Safety and Health Plan (SSHP) has been prepared for the Engineering Evaluation/Cost Analysis (EE/CA) for Waikoloa Maneuver Area, Kamuela, Island of Hawaii. The purpose of this SSHP is to establish site-specific safety and health procedures, practices and equipment to be implemented and used to protect affected personnel from the potential hazards associated with the field activities to be performed at the project site. The SSHP assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are being conducted during the EE/CA process.

### D.2 APPLICABILITY

This plan's provisions are mandatory for all on-site activities undertaken by USA Environmental, Inc. (USA) and its subcontractor(s) while at the Waikoloa Maneuver Area. All site activities will comply with the applicable standards in 29 CFR Parts 1910.120. As site conditions change, this plan may need to be modified. Such modifications will be submitted as SSHP addenda and will be numbered sequentially. All SSHP addenda must be reviewed and approved by the Corporate Safety and Health Manager and CIH.

All on-site personnel must read and understand this SSHP and sign the SSHP Acceptance Form (Attachment 1) prior to the start of work at the site. An unbound copy of this form will be used for signatures and will be maintained on site. A copy of the signed form will be returned to the USA Environmental corporate office and placed in the project file. This SSHP addresses those tasks that USA will perform on-site. Personnel involved in activities at this site must fully understand and comply with all pertinent requirements associated with this project.

### D.3 SITE DESCRIPTION AND CONTAMINANT CHARACTERIZATION

#### D.3.1 Site Location and Physical Description

The former Waikoloa Maneuver Area is approximately 30 miles north of the city of Kailua-Kona in the South Kohala District. The former maneuver area is bordered by Queen Kaahumanu Highway (State Highway 19) on the west, the South Kohala/North Kona District boundary line to the south, the South Kohala/Hamakua District boundary line to the east, and Kawaihae Road to the north. The former maneuver area is located on the rolling upland slopes of ancient basaltic lava flows, cut by widely spaced erosion gullies. Soil types within the former maneuver area are largely shallow, dry, and/or stony, and are subject to aeolian (windblown) conditions leaving a thin veneer of silt loam as top soil. These soil conditions, along with the semiarid climate, lend itself to large expanses of grassland along with sparse stands of vegetation, including cactus and eucalyptus trees.

Due to the large size and varied elevation (i.e., sea level to 5,500 feet above mean sea level) of the former maneuver area, several climatic zones are present. At the westernmost boundary along the Pacific Ocean, the climate is classified as a hot desert. As the land rises eastward up the slope of Mauna Kea, the former maneuver area is transected by a band of hot, semi-desert conditions that terminate at its far eastward reach in a summer-dry, warm temperate climate. Temperatures within the former maneuver area range from the high 90s to the low 50s (in degrees Fahrenheit).

SITE LOCATION	APPROXIMATE SIZE (Acres)
<b>Hawaiian Homelands Area</b>	<b>11,070</b>
<b>Area North of Kawaihae Road</b>	<b>3000</b>
<b>Area West of Queens Kaahumanu Highway</b>	<b>2500</b>
TOPOGRAPHY	PRESENT USAGE
<input type="checkbox"/> Forested <input checked="" type="checkbox"/> Open Terrain <input type="checkbox"/> River/Creeks <input type="checkbox"/> Wetland <input checked="" type="checkbox"/> Grassland <input checked="" type="checkbox"/> Arid <input type="checkbox"/> Flat land <input type="checkbox"/> Tillage <input checked="" type="checkbox"/> Other: Rocky terrain and erosion gullies	<input checked="" type="checkbox"/> Rural <input type="checkbox"/> Urban <input type="checkbox"/> Ag Business <input type="checkbox"/> Commercial <input checked="" type="checkbox"/> Farming <input type="checkbox"/> Industrial <input checked="" type="checkbox"/> Ranching <input type="checkbox"/> Mining <input type="checkbox"/> Military <input checked="" type="checkbox"/> Residential : Minimal <input checked="" type="checkbox"/> Government <input type="checkbox"/> Recreational <input checked="" type="checkbox"/> Other: Resort Areas

**D.3.2 Contamination Characterization**

CHEMICAL CONTAMINANT LISTING				
Chemical Name	Conc. Range	Media: Air Water, Soil	Location	Quantity Expected
NONE	N/A	N/A	N/A	N/A

**D.3.3 Ordnance/Explosives Contamination Characterization**

ORDNANCE/EXPLOSIVES CONTAMINATION			
TYPE	AMOUNT	LOCATION	SURFACE/ SUBSURFACE
Hand Grenade, MK II	TBD	TBD	TBD
Rifle Grenade, M9	TBD	TBD	TBD
Mortar, 60mm	TBD	TBD	TBD
Mortar, 81mm	TBD	TBD	TBD
Projectile, 37mm	TBD	TBD	TBD
Projectile, 75mm	TBD	TBD	TBD
Projectile, 105mm	TBD	TBD	TBD
Rocket, 2.36 Inch	TBD	TBD	TBD
Rocket, 4.5 Inch	TBD	TBD	TBD
Fuzing, Various	TBD	TBD	TBD

**D.4 SCOPE OF WORK**

The purpose of the EE/CA is to characterize OE contamination, analyze risk management alternatives, and recommend feasible OE risk reduction alternatives for the Waikoloa Maneuver Area for the selection of the most appropriate OE Response Action necessary to reduce public safety risk associated with OE/UXO that may exist on and around the Waikoloa Maneuver Area project site. The Phase III EE/CA will cover 16,570 acres not previously investigated during the Phase I and Phase II EE/CA. This SSHP will be used in conjunction with the WP.

**D.5 PROJECT TEAM ORGANIZATION**

Several organizations are directly involved in the Maneuver Area EE/CA project. The principal organizations are introduced in the following paragraphs.

**D.5.1 U.S. Army Corps of Engineers, Pacific Ocean Hawaii (POH)**

USACE POH is the PM and funding agency for this project. USACE POH's responsibilities include review of project plans and documents, obtaining rights-of-entry into the investigation areas, working with the news media and the public, and coordinating with state and local regulatory agencies on issues pertaining to protection of ecological and cultural resources.

**D.5.2 U.S. Army Corps of Engineers, Huntsville Center (USAESCH)**

USAESCH is the implementing agency for the execution of this project and provides technical expertise for this project. USAESCH's responsibilities include procurement of architect/engineer services, review and coordination of project plans and documents, and working with the news media and the public.

**D.5.3 USA Environmental, Inc. (USA)**

USA Environmental is the prime contractor to USAESCH and will provide overall support and services for the EE/CA. USA is responsible for performing the activities detailed in the Statement of Work (SOW). USA is also responsible for schedule and budget control. USAESCH's Contracting Officer directs all work to be performed by USA and its subcontractors.

**D.6 RESPONSIBILITIES OF PERSONNEL**

The names of the principal personnel are listed in Table D-1. The health and safety training of the on-site personnel will be provided to USAESCH PM for approval prior to mobilization to the field. Table D-2 describes the responsibilities of all on-site personnel. Figure D-1 illustrates the chain of command for on-site safety functions.

Table D-1. Principal Personnel and Responsibilities

TITLE	NAME	RESPONSIBILITY	PHONE NO.
POH District Project Manager	Chuck Streck	Overall Responsibility and Funding	(808) 438-6934
USAESCH OE Project Manager	Bob Nore	Project Responsibility	(256) 895-1507
USACE OE Safety Specialist	TBD	Overall USACE responsibility for Safety during the Prove-Out.	TBD
USA UXOSO	TBD	Overall USA responsibility for safety during site related activities.	(813) 884-5722
USA Safety and Health Manager	Robert Crownover	Overall Corporate Safety Responsibility	(813) 884-5722
USA Project Manager	David Synakorn	Overall Project Responsibility	(813) 884-5722
USA Sr. Geophysicist	Alan Crandall	Overall Site Management during DGM Activities	(813) 884-5722
Certified Industrial Hygienist	Jose J. Sosa	Corporate Review and Plan Approval	(813) 888-6525

Table D-2 Responsibilities of On Site Personnel

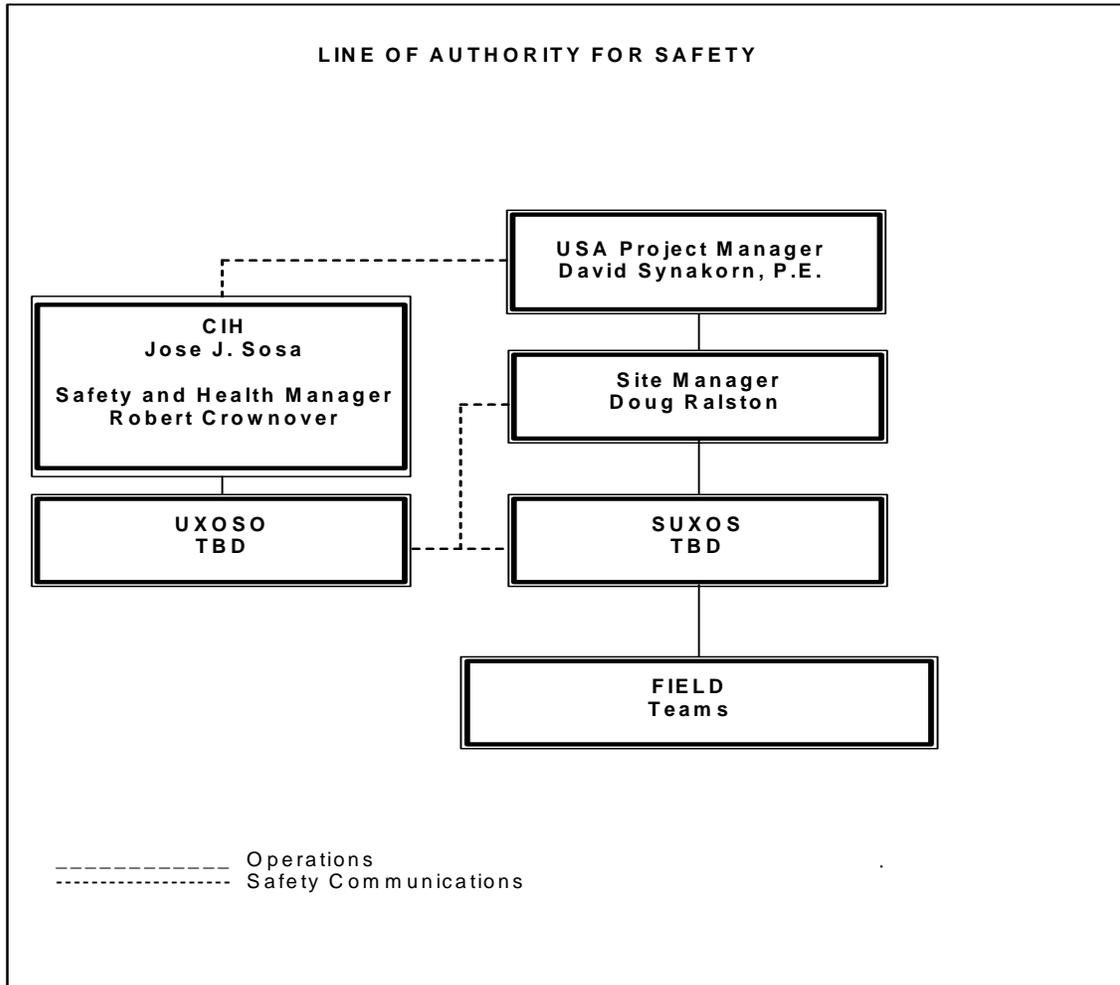
Title	General Description	Responsibility
Project Manager (USA)	<p>Reports to upper-level management. Has authority to direct response operations. Assumes total control over site activities.</p>	<ul style="list-style-type: none"> <li>• Prepares and organizes the background review of the situation, the Work Plan, the Site-Specific Safety and Health Plan, and the field team.</li> <li>• Assists USACE with obtaining permission for site access and coordinating activities with appropriate officials.</li> <li>• Ensures that the Work Plan is completed and on schedule.</li> <li>• Briefs field team on their specific assignments.</li> <li>• Uses the site safety and health officer to ensure that safety and health requirements are met.</li> <li>• Prepares the final report and support files on the response activities.</li> </ul>
Corporate Health and Safety Manager (USA)	<p>Advises the Project Manager on all aspects of health and safety. Stops work if any operation threatens work or public health or safety. Reports to Corporate Program Manager.</p>	<ul style="list-style-type: none"> <li>• Confirms each USA team member's suitability for work based on physician's recommendation.</li> <li>• Conducts field safety and health audits to ensure Safety and Health Plan conformance and USA policy compliance.</li> <li>• Certifies that all workers have proper training as per 29 CFR 1910.120(e).</li> </ul>
SUXOS (USA)	<p>Responsible for field team operations and safety of project personnel. Advises the Site Manager on all aspects of ongoing operations.</p>	<ul style="list-style-type: none"> <li>• Manages field operations.</li> <li>• Executes the Work Plan and schedule.</li> <li>• Has STOP WORK authority for operational reasons.</li> <li>• Coordinates with the UXOSO in determining appropriate safety levels.</li> <li>• Enforces the WP.</li> <li>• Serves as liaison with public officials.</li> </ul>

Title	General Description	Responsibility
<p>UXOSO (USA)</p>	<p>Advises the Site Manager on all aspects of health and safety on site.</p> <p>Stops work if any operation threatens work or public health or safety.</p> <p>Maintains a direct line of communication with the Corporate Safety and Health Manager and CIH.</p> <p>Reports directly to the Safety and Health Manager.</p>	<ul style="list-style-type: none"> <li>• Implements and enforces the SSHP.</li> <li>• Has STOP WORK authority for safety and health reasons.</li> <li>• Establishes work zones and controls access to these zones.</li> <li>• Confirms all USA personnel's suitability for work, based upon OSHA and site specific medical and training requirements.</li> <li>• Conducts site-specific safety training prior to initiation of field activities.</li> <li>• Conducts daily tailgate safety meetings.</li> <li>• In consultation with the CIH and Safety Manager determines the appropriate level of PPE to be used.</li> <li>• Ensures proper selection, condition, maintenance, storage, and use of PPE.</li> <li>• Investigates accidents/incidents and "near misses".</li> <li>• Enforces the "buddy" system.</li> <li>• Maintains and calibrates safety monitoring equipment, and document calibration data in the monitoring or safety log.</li> <li>• Restricts site personnel from site activities if they exhibit symptoms of alcohol or drug use or illness.</li> <li>• Continually monitors site personnel for signs of chemical exposure or physical stress.</li> <li>• Maintains the site safety and monitoring logs.</li> </ul>
<p>Corporate Certified Industrial Hygienist</p>	<p>Advises the Project Manager, Safety Manager, and the UXOSO on all aspects of safety and health related to the project site.</p>	<ul style="list-style-type: none"> <li>• Reviews and approves all SSHPs.</li> <li>• Determines types, levels and approved usage of safety equipment and PPE.</li> <li>• Conducts audits and investigations as necessary.</li> <li>• Ensures implementation and adherence to approved SSHPs.</li> <li>• Maintains lines of communication with project management personnel.</li> </ul>

**WAIKOLOA MANEUVER AREA WORK PLAN****KAMUELA, ISLAND OF HAWAII**

<b>Title</b>	<b>General Description</b>	<b>Responsibility</b>
Site Manager (USA)	Responsible for field team operations and safety. Advises the Project Manager on all operational aspects.	<ul style="list-style-type: none"><li>• Manages field operations.</li><li>• Executes the Work Plan and schedule.</li><li>• Has STOP WORK authority for operational reasons.</li><li>• Coordinates with the UXOSO in determining PPE levels.</li><li>• Enforces site control.</li><li>• Serves as liaison with public officials.</li></ul>
Work Team (USA)	The work team must consist of at least two personnel.	<ul style="list-style-type: none"><li>• Safely completes the onsite tasks required to fulfill the Work Plan.</li><li>• Complies with the SSHP.</li><li>• Notifies UXOSO or Supervisor of suspected unsafe conditions.</li><li>• Inspects PPE prior to, during and after each use.</li></ul>

Figure D-1. Line of Authority for Safety



## **D.7 HAZARD ASSESSMENT AND RISK ANALYSIS**

### **D.7.1 Introduction**

USA has performed a hazard assessment and risk analysis for each task to be performed on-site by USA personnel. Table D-3 summarizes this analysis. The hazards identified are further discussed in the following paragraphs and Hazards Analysis Sheets are located in Attachment 3 of this document.

The number of persons visiting the site shall be held to a minimum. A UXOSO will be on site to observe operations. The UXOSO may modify this SSHP if site conditions warrant and without risking the safety and health of the team members. Any modifications will be coordinated with the team members and the UXOSO shall notify the Corporate Health and Safety Manager prior to any changes as the situation allows.

## **D.8 TASK HAZARDS**

### **D.8.1 Install Geophysical Prove-out Plot**

- Exposure to hazards associated with surface OE. These items if moved or handled improperly could detonate, either killing or seriously injuring personnel at the work site;
- Exposure to hazards associated with subsurface OE while establishing plot boundaries and placing stakes or markers in the ground. Failure to follow UXO avoidance techniques could result in a detonation either killing or seriously injuring personnel at the work site;
- Exposure to biological hazards, such as insects, mosquitoes, scorpions, spiders, or other wildlife, and hazardous plants. These present the possibility of bites/stings and associated diseases or rash/infections;
- Potential trip hazards associated with ground cover, irregular terrain or debris; and
- Heat or cold stress as environmentally dictated.

### **D.8.2 Perform Location Surveying and Mapping**

- Exposure to hazards associated with surface OE. These items if moved or handled improperly could detonate, either killing or seriously injuring personnel at the work site;
- Exposure to hazards associated with subsurface OE while establishing boundaries and placing survey stakes or survey markers/monuments in the ground. Failure to follow UXO avoidance techniques could result in a detonation either killing or seriously injuring personnel at the work site;
- Exposure to biological hazards, such as insects, mosquitoes, scorpions, spiders, or other wildlife, and hazardous plants. These present the possibility of bites/stings and associated diseases or rash/infections;
- Potential trip hazards associated with ground cover, irregular terrain or debris; and
- Heat or cold stress as environmentally dictated.

**D.8.3 Perform Limited Vegetation Removal**

- Exposure to hazards associated with surface OE. These items if moved or handled improperly could detonate, either killing or seriously injuring personnel at the work site;
- Exposure to hazards associated with vegetation removal techniques utilizing mechanical or manual means;
- Noise, foot, and eye hazards associated with powered equipment;
- Exposure to biological hazards, such as insects, mosquitoes, scorpions, spiders, or other wildlife, and hazardous plants. These present the possibility of bites/stings and associated diseases or rash/infections;
- Potential trip hazards associated with ground cover, irregular terrain or debris; and
- Heat or cold stress as environmentally dictated.

**D.8.4 Perform OE Investigations and Disposal**

- Exposure to hazards associated with surface or subsurface OE. These items if moved or handled improperly could detonate, either killing or seriously injuring personnel at the work site;
- Transportation hazards inherent in the driving of vehicles and movement of OE and/or demolition materials
- Exposure to explosive hazards associated with demolition operations;
- Exposure to biological hazards, such as insects, mosquitoes, scorpions, spiders, or other wildlife, and hazardous plants. These present the possibility of bites/stings and associated diseases or rash/infections;
- Lifting hazards associated with movement of equipment;
- Potential trip hazards associated with ground cover, irregular terrain or debris; and
- Heat or cold stress as environmentally dictated.

**D.8.5 Perform OE/UXO Avoidance**

- Exposure to hazards associated with surface or subsurface OE. These items if moved or handled improperly could detonate, either killing or seriously injuring personnel at the work site;
- Exposure to biological hazards, such as insects, mosquitoes, scorpions, spiders, or other wildlife, and hazardous plants. These present the possibility of bites/stings and associated diseases or rash/infections;
- Lifting hazards associated with movement of equipment;
- Potential trip hazards associated with ground cover, irregular terrain or debris; and
- Heat or cold stress as environmentally dictated.

**D.8.6 Turn-In of Recovered OE/UXO Related and Non- Related Scrap**

- Exposure to hazards associated with surface OE. These items if moved or handled improperly could detonate, either killing or seriously injuring personnel at the work site;
- Exposure to biological hazards, such as insects, mosquitoes, scorpions, spiders, or other wildlife, and hazardous plants. These present the possibility of bites/stings and associated diseases or rash/infections;
- Explosive hazards as a result of inerting/venting UXO scrap;
- Lifting hazards associated with the collection, inspection, and movement of scrap;

- Cuts and lacerations associated with the collection, inspection, and movement of scrap;
- Potential trip hazards associated with ground cover, irregular terrain or debris; and
- Heat or cold stress as environmentally dictated.

**D.8.7 Perform Quality Control**

- Exposure to hazards associated with surface or subsurface OE. These items if moved or handled improperly could detonate, either killing or seriously injuring personnel at the work site;
- Exposure to biological hazards, such as insects, mosquitoes, scorpions, spiders, or other wildlife, and hazardous plants. These present the possibility of bites/stings and associated diseases or rash/infections;
- Potential trip hazards associated with ground cover, irregular terrain or debris; and
- Heat or cold stress as environmentally dictated.

**D.9 CHEMICAL HAZARDS**

Studies of this project area have not identified any chemical hazards on the site. If any chemical hazards are suspected, work will be stopped and appropriate procedures will be adopted. Should suspected chemical warfare material (CWM) be encountered during this investigation personnel will immediately withdraw upwind to a safe location, notify the on-site USACE OE Safety Specialist and await instructions.

Table D-3. Activity Hazard/Risk Analysis

HAZARDS: Safety, Chemical, Physical, Radiological, Biological, OE (*See Below)	ACTION LEVELS: (**See Below)
- Safety Hazards include falling (open pits, rocks, steep inclines, slippery surfaces); climbing (uneven terrain); walking (uneven terrain, surface indentations); eye hazards (windy conditions); and OE. - Chemical: None anticipated. - Physical Hazards include heat or cold injuries. - Radiological: None anticipated. - Biological hazards present insects, scorpions, spiders, hazardous plants. - OE hazard potential.	None/Awareness/Avoidance  Not Applicable Per Monitoring Requirements Not Applicable None/Awareness/Avoidance  Observe Safety Procedures

Table D-3 Activity Hazard/Risk Analysis (Continued)

**\*HAZARDS:** Notes to Hazard/Risk Analysis:**Safety:**

Falling: (e.g. Open pits; wells; shafts; rocks crevices; steep inclines; slippery surfaces; etc.)

Climbing: (e.g. Falls from structures > 4 feet; deteriorated ladders or missing rungs; etc.)

Walking or Debris: (e.g. Uneven terrain; animal burrows; surface indentations; exposed nails; broken timbers; sharp protruding objects; broken glass; metal fragments; etc.)

Confined Space (e.g. Excavations > 4 feet deep; surface/underground utility vaults; open surface tanks/cisterns/septic tank; underground/above ground storage tanks; etc.)(DO NOT ENTER)

Water: (e.g. Moving waterways (Flash Floods); drowning/near drowning conditions or environments; etc.)

Eye Hazards: (e.g. Airborne dust/windy conditions; liquid splashes, flying objects; etc.)

OE/Other: (e.g. Explosives; combustible or flammable materials; etc.)

**Chemical:** Evaluate the chemical hazards that may be encountered during site activities for each task. For activities utilizing this plan, encounters with chemicals above the PEL, or TLV are not expected. THIS PLAN SHALL NOT BE USED IF OVEREXPOSURES OR IDLH CONDITIONS ARE EXPECTED. (List the chemical TLV/PEL/REL; OSHA/NIOSH IDLH; odor threshold/warning levels; warning signs/symptoms of overexposure; concentrations expected on site.)

**Physical:** Evaluate the potential for injury from physical agents such as noise, electricity, moving parts/machinery, heat and cold stress that may be present (e.g. loud machinery; overhead or underground power lines; personal protective clothing, etc.)

**Radiological:** Evaluate the risk to human health caused by radioactive materials in the area where work is to be performed.

**Biological:** Evaluate the potential for illness of injury due to biological agents (e.g. hazardous plants, animals, insects, microorganisms, etc.)

**OE:** Evaluate exposure; minimize people, time, and amount of hazardous material. Age or condition of ordnance DOES NOT decrease hazard. Ordnance exposed to fire is EXTREMELY hazardous: EVACUATE IMMEDIATELY.

**\*\*ACTION LEVELS:**

Action Levels shall typically be defined as requiring site evacuation only, if significant hazards are encountered. Note: The activities for which this SSHP is designed, will not typically encounter chemical contaminant or radioactive exposures above background. In the event that chemical or radioactive exposures, which are judged to be significant, are encountered (reasonable potential to exceed permissible exposure limits or encounter IDLH conditions) this plan requires work stoppage of the site, reevaluation, and development of procedures designed by Safety Management which will address the potential overexposures.

## D.10 PHYSICAL HAZARDS

### D.10.1 Ordnance Hazards

Ordnance and ordnance-related items may be encountered at the site. Personnel should be alert for OE and OE-related scrap. The following general precautions with regards to ordnance will be observed at all times:

- DO NOT touch or move any ordnance item(s) regardless of the markings or apparent condition.
- DO NOT visit an ordnance site if an electrical storm is occurring or approaching. If a storm approaches during a site visit, leave the site immediately and seek shelter.
- DO NOT use radios or cellular phones in the vicinity of suspect ordnance items.
- DO NOT walk across an area where the ground cannot be seen. If dead vegetation or animals are observed, leave the area immediately due to potential contamination by chemical agent.
- DO NOT drive vehicles into a suspected OE area, use clearly marked lanes.
- DO NOT carry matches, lighters, or other flame-producing devices onto an OE site.
- DO NOT rely on color code for positive identification of ordnance item(s) nor their contents.
- Approach ordnance items from the side, avoid approaching the front or rear areas.
- Always assume ordnance items contain a live charge until it can be ascertained otherwise.

### D.10.2 Specific Actions to Be Taken Upon Locating Ordnance

- Do not be misled by markings on the ordnance item stating practice or inert. Even practice items may have explosive charges that are used to mark/spot the point of impact; or the item could be incorrectly marked.
- Do not roll the item over or scrape the item to identify the markings.
- The location of any ordnance items found during site investigation should be clearly marked so it can be easily located and avoided. Follow the procedures set forth in the WP.
- Upon locating any OE or suspect OE, notify the SUXOS, UXOSO and the onsite USACE OE Safety Specialist so appropriate measures can be taken.

### D.10.3 General Safety Hazards

- Slip, trip and fall hazards may be encountered at the site including holes, pits, erosion areas, and uneven grades. Personnel should use caution when traversing the site and should report any such hazards to the Site Manager/SUXOS and UXOSO if they are discovered.
- Site rules/prohibitions: Use the buddy system during all activities on the site. Eating, drinking, and smoking will be performed in designated areas only.
- Work Permit requirements: None Required. [e.g. No radioactive work, hot work, confined space, etc.]
- Material handling procedures: Do not handle soils, liquids, or other materials unnecessarily.
- Drum/container handling procedures and precautions: Do not open, sample or overpack unless directed to do so.
- Confined space entry procedures: Avoid/ DO NOT ENTER.

- Sources of ignition, fire protection/ prevention, and electrical safety: Avoid all electrical hazards, smoking will be permitted in UXOSO-designated areas only. Avoid spark producing objects.
- Excavation and trench safety: Avoid/DO NOT ENTER.
- Guarding of machinery and equipment: Observe applicable precautions and warnings for project required equipment.
- Lockout/Tagout: N/A
- Fall protection: No structural climbing, avoid potential areas where fall through could occur.
- Hazard Communication: Review and follow precautions, know potential site hazards.
- Illumination: Work performed during daylight hours only; flashlights maybe carried for emergency use.
- Sanitation: Sanitation facilities will be made available at the Waikoloa Maneuver Area project site.
- Engineering controls: Determined by the task performed. Safe separation distances for teams and the public at large will be imposed.
- Process Systems Safety: N/A
- Signs and labels: Signs identifying the area under operations will be posted. Labels on OE/OE related scrap containers will be used to identify the contents.

#### **D.10.4 Cold Related Illness**

##### **D.10.4.1 General**

Even in moderate climates, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Recognition of the symptoms of cold related illness will be discussed during the health and safety briefing conducted prior to the onset of site activities. Refer to the 2003 American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) for Chemical Substances and Physical Agents for additional information on cold stress prevention, monitoring, and work-warming regimens.

##### **D.10.4.2 Hypothermia**

Hypothermia is a life-threatening condition in which the core body temperature falls below 95°F. Hypothermia can occur at temperatures well above freezing particularly, when the skin or clothing becomes wet. During exposure to cold, maximum shivering occurs when the core temperature falls to 95°F. As hypothermia progresses, depression of the central nervous system becomes increasingly more severe. This accounts for the progressive signs and symptoms ranging from sluggishness and slurred speech to disorientation and eventually unconsciousness (see Table D-4). The ability to sustain metabolic rate and to reduce skin blood flow is diminished by fatigue. Thus, fatigue increases the risk of severe hypothermia by decreasing metabolic heat.

Table D-4. Progressive Clinical Symptoms of Hypothermia

CORE TEMPERATURE (°F)	CLINICAL SIGNS
95°	Maximum shivering
87° - 89°	Consciousness clouded; blood pressure becomes difficult to obtain; pupils dilated
84° - 86°	Progressive loss of consciousness; muscular rigidity; respiratory rate decreases
79°	Victim rarely conscious
70° - 72°	Maximum risk of ventricular fibrillation

**D.10.4.3 Prevention of Cold Related Illness**

- Educate worker to recognize the symptoms of hypothermia.
- Ensure the availability of an enclosed, heated environment within the vehicles. The nearest heated environment will be the interior of the vehicles at the site.
- Ensure the availability of dry changes of clothes.
- Record temperature readings.
- Ensure the availability of warm beverages, preferably a caffeine-free beverage.

**D.10.4.4 Monitoring for Cold Exposure**

Cold stress monitoring will be conducted in accordance with the ACGIH cold stress TLV. The TLV objective is to prevent the deep body core temperature from falling below 96.8°F and to prevent cold injury to body extremities. Temperature monitoring and recording will be initiated in the following situations:

- At the UXOSO’s discretion when suspicion is based on changes in worker’s performance or mental status.
- At worker’s request.
- As a screening measure whenever any one worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

**D.10.5 Heat Related Illness**

**D.10.5.1 General**

Heat stress is one of the most common (and potentially serious) illnesses that affect OE site workers. When site personnel are engaged in operations involving hot environments, a number of physiological responses can occur which may seriously affect the health and safety of the workers. These affects can be eliminated or controlled through the use of a comprehensive heat stress prevention and monitoring program.

Individuals vary in their susceptibility and degree of response to stress induced by increased body heat. Heat stress can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is cause by a number of interacting factors including environmental condition, clothing, workload, and the individual characteristics of the worker. Because heat stress is probably one of the most common (and potentially serious) illnesses at OE sites,

regular physiological monitoring, area monitoring, or use of portable heat stress meters (as appropriate) and other preventive precautions/methods are vital and may be used at the project site.

Factors that may predispose a worker to heat stress include:

- Lack of physical fitness.
- Lack of acclimatization to hot environments.
- Degree of hydration.
- Level of obesity.
- Current health (i.e., having an infection, chronic disease, diarrhea, etc.).
- Alcohol or drug use.
- The worker's age and sex.
- Prior history of heat stress.

The amount and type of PPE worn directly influence reduced work tolerance and the increased risk of excessive heat stress. PPE adds weight and bulk, severely reduces the body's access to normal heat exchange mechanisms (evaporation, convection, and radiation), and increases energy expenditure. Therefore, when selecting PPE, each item's benefit should be carefully evaluated in relation to its potential for increasing the risk of heat stress. Once PPE is selected, the safe duration of work/rest periods should be determined based on the:

- Anticipated work rate.
- Ambient temperature and other environmental factors.
- Type of protective ensemble.
- Individual worker characteristics and fitness.

Sweating does not cool the body unless moisture is removed from the body. The use of personal protective equipment (PPE) reduces the body's ability to eliminate large quantities of heat because the evaporation of sweat is decreased. The body's effort to maintain an acceptable temperature may become impaired and this may cause heat stress. Increased body temperature and physical discomfort also promote irritability and a decreased attention to the performance of hazardous tasks. At the Waikoloa Maneuver Area, Level D PPE will be utilized, thus providing minimal increase in the potential for heat stress. Level D PPE is defined as standard work clothes with sturdy work boots, long pants, short or long sleeve shirt as applicable, safety glasses, appropriate gloves, hard hats and safety boots (when working around heavy equipment).

#### **D.10.5.2 Early Symptoms of Heat Related Problems:**

- Decline in task performance
- Lack of coordination
- Decline in alertness
- Unsteady walk
- Excessive fatigue
- Muscle cramps
- Dizziness

**D.10.5.3 Heat Stress Disorders**

**D.10.5.3.1 General:** This section outlines the major heat related illness that may result from exposure to high heat environments, which include heat rash, fainting, heat cramps, heat exhaustion, and heat stroke. For the purpose of this program, reference to “liquids” will indicate the use of water or an electrolyte replacement solution, and not tea or coffee (unless it is decaffeinated) or carbonated soft drinks.

**D.10.5.3.2 Heat Rash**

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by wet chafing clothing. This condition can decrease a worker’s ability to tolerate hot environments.

- Symptoms: Mild red rash, especially in areas of the body that sweat heavily.
- Treatment: Decrease amount of time in protective gear and provide powder such as corn starch or baby powder to help absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes if needed.

**D.10.5.3.3 Heat Cramps**

Heat cramps are caused by a profuse rate of perspiration that is not balanced by adequate fluid and electrolyte intake. The occurrence of heat related cramps are often an indication that excessive water and electrolyte loss has occurred, which can further develop into heat exhaustion or heat stroke.

- Symptoms: Acute, painful spasms of voluntary muscles such as the back, abdomen and extremities.
- Treatment: Remove victim to a cool area and loosen restrictive clothing. Stretch and massage affected muscles to increase blood flow to the area. Have the patient drink one to two cups of liquids immediately, and every twenty minutes thereafter. Consult with a physician if condition does not improve. If available, an electrolyte replacement solution should be taken along with liquids.

**D.10.5.3.4 Heat Exhaustion**

Heat exhaustion occurs due to the large fluid and salt loss from profuse sweating. It is a state of very definite weakness or exhaustion caused by increased stress on various organs to meet increased demands to cool the body due to excessive loss of fluids from the body. This condition leads to inadequate blood supply and cardiac insufficiency. Heat exhaustion is less dangerous than heat stroke, but nonetheless must be treated. If allowed to go untreated, heat exhaustion can quickly develop into heat stroke.

- Symptoms: Pale or flushed, clammy, moist skin, profuse perspiration, and extreme weakness. Body temperature is basically normal or slightly elevated, the pulse is weak and rapid, and breathing is shallow. The individual may have a headache, be dizzy or nauseated.
- Treatment: Remove the individual to a cool, air-conditioned place, loosen clothing, elevate feet and allow individual to rest. Consult physician, especially in severe cases. Have patient drink one to two cups of liquids immediately, and every twenty minutes thereafter. Total liquid consumption should be

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about one to two gallons per day. If the signs and symptoms of heat exhaustion do not subside, or become more severe, immediate medical attention will be required.

#### **D.10.5.3.5 Heat Stroke**

Heat stroke is an acute and dangerous reaction to heat stress caused by failure of the heat regulating mechanisms of the body. Heat stroke occurs when the body's system of temperature regulation fails and the body temperature rises to critical levels. When this occurs, the body core temperature rises very rapidly to a point (>105.8°F) where brain damage and death may result if the person is not cooled quickly.

- Symptoms:** The victim's skin is hot, and may or may not be red, dry and/or spotted, due to the fact that the individual may still be wet from having sweat while wearing protective clothing earlier; nausea; dizziness; confusion; extremely high body temperature; rapid respiratory and pulse rate; delirium; convulsions; unconsciousness or coma.
- Treatment:** Cool the victim immediately. If the body temperature is not brought down quickly, permanent brain damage or death may result. The victim should be moved to a shady area; he should lie down and keep head elevated. Cool the victim by either sponging or immersing the victim in very cool water to reduce the core temperature to a safe level (<102°F). If conscious, give the victim cool liquids to drink. Observe the victim and obtain immediate medical help. Do not give the victim any beverage containing caffeine or alcoholic. Heat stroke is considered a medical emergency. Medical help should be summoned immediately. **EARLY RECOGNITION AND TREATMENT OF HEAT STROKE ARE THE ONLY MEANS OF PREVENTING BRAIN DAMAGE OR DEATH.**

#### **D.10.5.4 Preventive Measures**

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat exhaustion, that person may become predisposed to additional heat injuries. In order to avoid heat related illnesses, proper preventive measures will be implemented whenever environmental conditions dictate the need, normally whenever the temperature reaches at least 70°F. These preventive measures represent the minimal steps to be taken and will include the following procedures:

- a. The UXOSO or other authorized person will observe site personnel prior to the start of daily operations, and periodically throughout the day, to determine the individuals susceptible to heat induced stress. Evidence of extreme dehydration, illness or drug or alcohol use may require the UXOSO to restrict the worker's activities until such time as the worker is fit for duty. Personnel identified as being at high risk for heat stress who are allowed to participate in site operations will be monitored frequently by the UXOSO.
- b. Site workers will be trained to recognize and treat heat-related illnesses. This training will include the signs, symptoms and treatment of heat stress disorders as outlined in this SSHP.
- c. In order to maintain workers' body fluids at normal levels, workers will be encouraged to drink, as a minimum, approximately sixteen ounces of liquids prior to start of work

- in the morning, after lunch and prior to leaving the site at the conclusion of the day's activities. Disposable four (4) to twelve (12) ounce cups and liquids will be provided on site. Workers are also encouraged to drink small amounts of water frequently throughout the day, e.g., one cup every 20 minutes. Liquids to be provided will be water. Liquids containing caffeine should be avoided.
- d. When ambient conditions and site workload requirements dictate, as determined by the UXOSO, workers will be required to drink a minimum of 16 to 32 ounces of liquids during each rest cycle. The normal thirst mechanism is not sensitive enough to ensure that enough water will be consumed to replace lost sweat. When heavy sweating occurs, workers shall be encouraged to drink even though they may not be thirsty.
  - e. A shelter or shaded area may be provided where workers can be protected from direct sunlight during rest periods.
  - f. Monitoring of ambient or physiological heat stress indices will be conducted to allow prevention and/or early detection of heat induced stress. Monitoring will be conducted in accordance with applicable paragraphs of this SSHP using approved heat stress meters or monitoring methods.
  - g. Site workers will be given time to acclimatize to site work conditions, temperature, protective equipment, and workload. Acclimatization is the adaptive process that usually takes two to six days of continued work in hot environments, resulting in a decrease of the physiological strain and allowing the worker's body to become adjusted to the level and type of work required by the application of a constant environmental stress. This process involves a gradual increase in the individual's workload over the required period, the length of which depends upon the nature of the work performed, ambient temperatures, and the individual's susceptibility to heat stress.
  - h. Work schedules will be adjusted as follows:
    - Modify work/rest schedules according to monitoring requirements.
    - Mandate work slowdowns as needed.
    - Rotate personnel: alternate job functions to minimize over-stress or overexertion at one task.
    - Add additional personnel to work teams.
    - Perform work during cooler hours of the day if possible.
  - i. Workers will be encouraged to achieve and maintain an optimum level of physical fitness. Increased physical fitness will allow workers to better tolerate and respond to hot environments and heavy workloads. In comparison to an unfit person, a fit person will have: less physiological strain; a lower heart rate and body temperature; and a more efficient sweating mechanism.
  - j. Alcohol should not be consumed in a hot environment because the loss of body fluids increases the risk of heat stress.

#### **D.10.5.5 Heat Stress Monitoring**

Because the incidence of heat stress depends on a variety of factors, all workers shall be monitored. Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work. The length of the work cycle will be governed by the frequency of the required physiological monitoring.

Monitoring of personnel wearing PPE should begin when the ambient temperature is 70°F or above. Table D-5 presents the suggested frequency for physiological monitoring when utilized. Monitoring frequency should increase as the ambient temperature increases or as slow recovery rates are observed. A person with a current first aid certification who is trained to recognize heat stress symptoms should perform heat stress monitoring. Other methods for determining heat stress monitoring, such as the wet bulb globe temperature (WBGT) index from American Conference of Governmental Industrial Hygienist (ACGIH) Threshold Limit Values (TLV) booklet or portable heat stress meter/monitoring instrumentation may be used on site.

For workers wearing permeable clothing (i.e., standard cotton work clothes), follow recommendations for monitoring requirements and suggested work/rest schedules in the current ACGIH Threshold Limit Values for Heat Stress.

When monitoring the worker physically, measure:

- Heart rate. Count the radial pulse during a 30-second period as early as possible in the rest period.
  - If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
  - If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.
- Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking).
  - If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.
  - If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third.
  - Do not permit a worker to wear a semi-impermeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

**D.10.5.6 Wet Bulb, Dry Globe Temperature (WBGT) Monitoring**

For site conditions where personnel are working in Level D PPE, and the ambient temperature is greater than 75°F, the UXOSO will conduct WBGT monitoring to assist in controlling the potential for site workers experiencing heat related adverse health affects. The UXOSO may take readings on a WBGT monitor throughout the day, with averages taken over a 60 minute period, to determine the work/rest schedule to be implemented. The values outlined in Table D-6 are designed such that nearly all acclimatized, fully clothed workers with adequate water and electrolyte replacement liquids intake will be able to function without the body temperature exceeding 100.4°F (38°C).

**D.10.5.7 Heat Stress Documentation**

The UXOSO will be responsible for recording all heat stress related information. This will include training sessions and monitoring data. Training sessions will be documented on the Safety Meeting and Training Form, and WBGT data and other information will be recorded on a heat stress monitor log.

Table D-5. Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers

ADJUSTED TEMPERATURE <sup>b</sup>	NORMAL WORK ENSEMBLE <sup>c</sup>	IMPERMEABLE ENSEMBLE
90°F (32.2°C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5°-90°F (30.8°-32.2°C)	After each 60 minutes of work	After each 30 minutes of work
82.5°-87.5°F (28.1°-28.1°C)	After each 90 minutes of work	After each 60 minutes of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 minutes of work	After each 90 minutes of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 minutes of work	After each 120 minutes of work

<sup>a</sup>. For work levels of 250 kilocalories/hour.

<sup>b</sup>. Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

<sup>c</sup>. A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

Table D-6. Permissible WBGT Heat Exposure Threshold Limit Values

Work – Rest Regimen	Work Load		
	Light*	Moderate	Heavy
Continuous work	86 (30.0)	80 (26.7)	77 (25.0)
75% Work - 25% Rest, each hour	87 (30.6)	82 (28.0)	78 (25.9)
50% Work - 50% Rest, each hour	89 (31.4)	85 (29.4)	82 (27.9)
25% Work - 75% Rest, each hour	90 (32.2)	88 (31.1)	86 (30.0)

\* Consult the ACGIH TLV booklet for definitions of Light, Moderate and Heavy workloads. Values are given in °F and (°C) WBGT, and are intended for workers wearing single layer summer type clothing. Use of semi or totally impermeable clothing requires monitoring IAW the Heat Stress Prevention Program. As workload increases, the heat stress impact on a non-acclimated worker is exacerbated. For non-acclimated workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5°C.

**D.11 RADIOLOGICAL HAZARDS**

No radiological hazards are suspected to be present at the site. If any radiological hazards are located or suspected, work will be stopped and personnel will immediately withdraw to a safe location. Personnel will act under the direction of the UXOSO to assist in any necessary evacuations. The USA Site Manager will notify the USACE OE Safety Specialist and USA Corporate Project Manager who will, in turn, notify the USACE PM. USA will provide training and equipment to site personnel, if deemed necessary, to continue site operations.

**D.12 BIOLOGICAL HAZARDS**

**D.12.1 General**

Biological hazards that are usually found on site include hazardous plants, and insects, such as spiders, mosquitoes, rodents, and bloodborne pathogens. Employee awareness and the safe work practices outlined in the following paragraphs should reduce the risk associated with these hazards.

**D.12.2 Hazardous Plants**

A number and variety of hazardous plants that may be encountered. The ailments associated with these plants range from mild hay fever to contact dermatitis, to carcinogenic affects. The plants that present the greatest degree of risk to site personnel (i.e. potential for contact vs. affect produced) are those that produce skin reactions and skin and tissue injury.

**D.12.3 Plants Causing Skin and Tissue Injury**

Contact with sharp leaves, nettles, and thorns are of special concern to site personnel. This concern stems from the fact that punctures, cuts and even minor scrapes caused by accidental contact may result in non-infectious skin lesions, and the introduction of fungi or bacteria through the skin or eye. This is especially important in light of the fact that the warm moist environment created inside protective clothing is ideal for the propagation of fungal and bacterial infection. Personnel receiving any of the injuries listed above, even minor scrapes, will report it immediately to the UXOSO for initial and continued observation and care of the injury. Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit much of the potential exposure.

**D.12.4 Plants Causing Skin Reactions**

The hazardous plants of greatest concern are those varieties found in the project area having nettles/spines/thorns. These plants may produce redness, blisters, swelling, and intense burning and itching due to punctures, scraps, or lacerations. The victim also may develop an infection should the nettles/spines/thorns break off inside the wound.

Improper treatment of an injury can cause secondary infections to occur. Preventive measures that can prove effective for most site personnel are:

- Avoid contact with any hazardous plants on site.
- Remove gloves prior to touching face, neck, or other exposed areas of the body.
- Wash hands, face or other exposed areas at the beginning of each break period and at the end of each workday.
- Keeping the skin covered as much as possible (i.e., long pants and long sleeved shirts) in areas where these plants are known to exist will limit potential exposure.

**D.12.5 Snakes**

Hawaii has no indigenous snake population. Therefore, snakes are not a concern.

**D.12.6 Insects**

Contact with stinging/biting insects may result in site personnel experiencing adverse health affects that range from being mildly uncomfortable to being life threatening. Therefore, stinging/biting insects present a serious hazard to site personnel and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging/biting insects. Poisonous or disease carrying insects and insect-like creatures that may be encountered at Waikoloa Maneuver Area project site include the following:

- Scorpions;
- Bees (honeybees, bumble bees, wasps, and hornets);
- Mosquitoes; and
- Spiders.

**D.12.6.1 Scorpions**

The scorpion is about one to two inches long, and it is commonly found resting on the underside of wood pieces, in crevices, or under rocks.

- All personnel will remain vigilant for the presence of these stinging insects.
- If stung, immediately inform the UXOSO to receive treatment as needed.



Figure D-2. Scorpion

**D.12.6.2 Bees, Wasps, Hornets**

Symptoms of an insect bite/sting are normally a sharp, immediate pain in the body part bitten. These insects include the following:

- Bees (honeybees, bumble bees, wasps, and hornets); and
- Beetles/Bugs.

Site personnel will comply with the following work practices:

- Personnel with a known hypersensitivity to bee, wasp, or hornet stings will inform the UXOSO of this condition prior to performing site activities.
- Personnel with a known hypersensitivity condition will keep emergency medication in their possession.
- All personnel will remain vigilant for the presence of these stinging insects. Discovered nests will be flagged and their location reported to other site personnel.
- If stung, immediately inform the UXOSO to receive treatment, per Figure D-4.

**D.12.6.3 Mosquitoes**

The Center for Disease Control (CDC) has noted the increase of mosquito borne viruses in the U.S., these are transmitted by bites from an infected mosquito. Mosquitoes live in nearly all environments, including urban, wooded, grassy, brushy, arid, tropical, or other areas that contain standing pools of water (seeps, drainage, watering holes, etc.).

The WNV disease has not been documented in Hawaii. Therefore, this section will pertain to mosquitoes as a nuisance to site personnel.

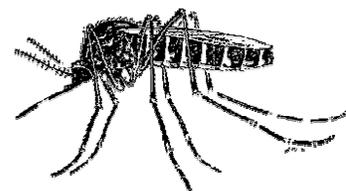


Figure D-3. Mosquitoes

**D.12.6.4 Protective Measures**

Standard field gear (work boots, hats, socks, trousers, and work shirts provide good protection against mosquito bites, exposed skin is particularly susceptible to bites. However, even when wearing field gear, the following precautions shall be taken when working in areas that might be infested with mosquitoes:

- Spray outer clothing **BUT NOT YOUR SKIN**, with an insect repellent that contains permethrin or permethrin.
- When working in infested areas apply an insect repellent containing 33 percent Deet to exposed skin and avoid standing water areas as much as possible.

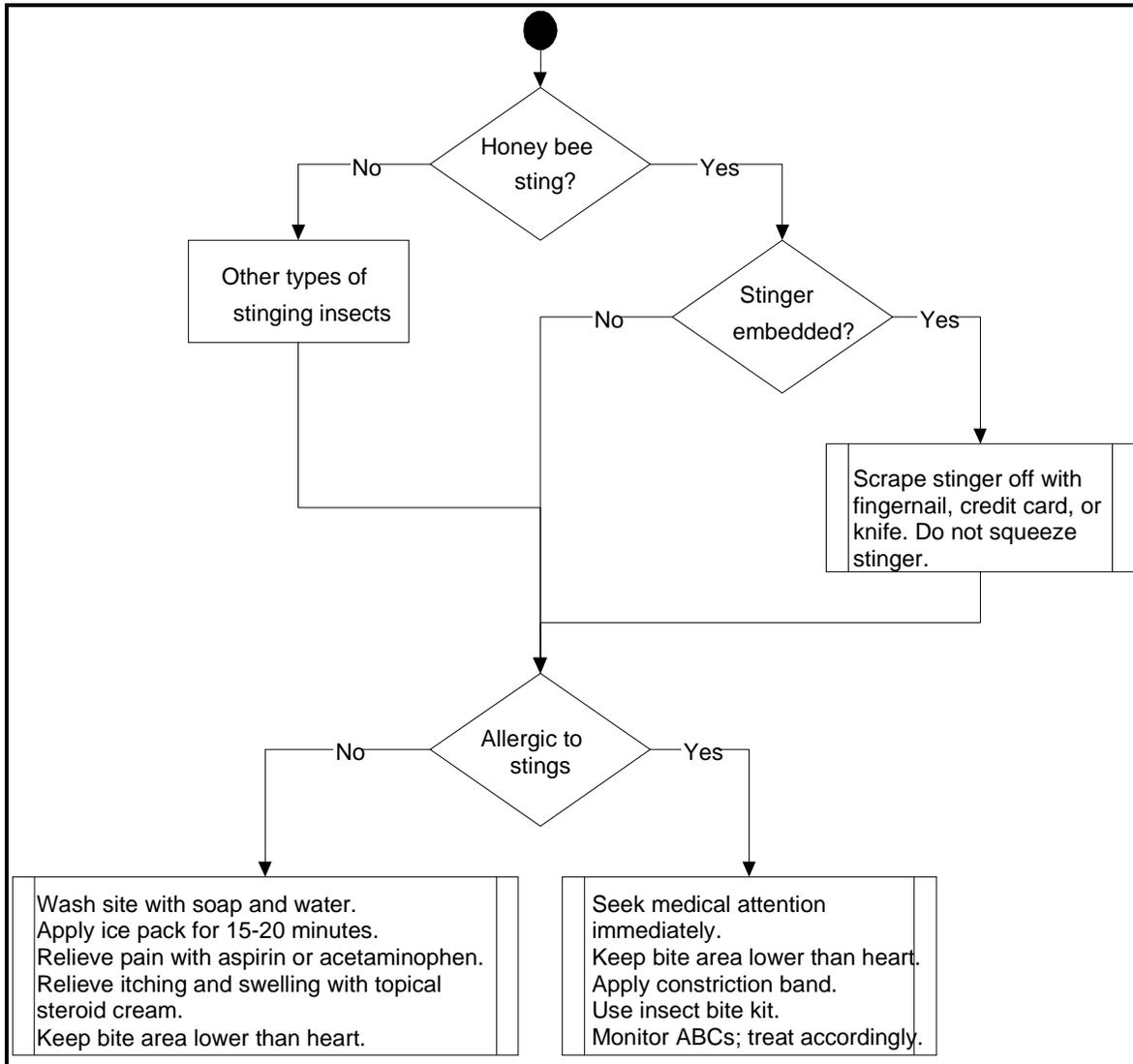


Figure D-4. Decision Diagram for Stings from Insects

### D.12.6.5 Spiders

Use extreme caution when lifting rocks, wood, and other debris, etc., since spiders are typically found in these areas. Poisonous spiders that may be encountered on the Waikoloa Maneuver Area project site are of the Black Widow family. The Black Widow is a small bulbous black spider with a red hourglass-shaped mark on the underside.

**Black Widow Spider**, common name for any of several related long-legged, smooth-bodied [spiders](#), chiefly inhabiting the Tropics, but also common in the southern United States and found as far north as Canada. They spin irregular webs in crevices and other dark, protected spots. The fully grown female of the familiar North American species is about 1.2 cm (about 0.5 in) long and is jet black, with an hourglass-shaped red mark on the underside of the abdomen. Males are only about half as long and usually have four pairs of red dots along the sides of the abdomen. Males are rarely seen and are harmless. Contrary to popular belief, the female black widow spider does not kill her partner after mating. The female's bite, poisonous to humans, is followed by local pain and swelling, nausea, and difficulty in breathing and is sometimes fatal. The venom, a neurotoxin, generally affects children more severely than adults. The spider, however, is not aggressive and bites humans only defensively.



Figure D-5. Black Widow

### D.12.9.1 First Aid:

- If possible, catch the spider to confirm its identity. Even if the body is crushed, save it for identification.
- Clean the bitten area with soap and water or rubbing alcohol.
- To relieve pain, place an ice pack over the bite.
- Keep the victim quiet and monitor breathing.
- Seek immediate medical attention.

### D.12.7 Rats, Mice, and Bats

Rats, mice, and bats may be found at the site. These animals may carry disease and should be avoided.

Preventive measures should focus on cleaning all cuts and scratches with soap and water, followed by rinsing with hydrogen peroxide. Put liquid skin on the affected areas. The best preventative measure is to avoid all rodent nests during geophysical surveys. If rodent nests are discovered field team members should be apprised of their locations and avoid working adjacent to the nests. If work must be performed at that location, a 10% bleach solution should be sprayed on the nest and adjacent areas to kill the virus. If work must be performed at a location where rodent infestation is evident, personal protective equipment should be worn. PPE shall be evaluated and procedures provided prior to work commencing.

### D.13 BLOODBORNE PATHOGENS

Bloodborne pathogens enter the human body and blood circulation system through punctures, cuts or abrasions of the skin or mucous membranes. They are not transmitted through ingestion (swallowing), through the lungs (breathing), or by contact with whole, healthy skin. However, under the principle of universal precautions (see below) all blood should be considered infectious, and all skin and mucous membranes should be considered to have possible points of entry for pathogens.

Potential bloodborne pathogen exposure include:

- Contact with contaminated medical equipment or medical waste or sharps.
- Medical emergency response operations such as administering first aid or CPR.
- Contact with human wastes such as domestic sewage.

#### D.13.1 Definitions

- Bloodborne Pathogens: Pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).
- Exposure Incident: A specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties.
- Other Potentially Infectious Materials: Semen, vaginal secretions, cerebro-spinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids, or any unfixed tissue or organ (other than intact skin) from a human, living or deceased.
- Parenteral: Piercing mucous membranes or the skin barrier through such events as needle sticks, human bites, cuts, and abrasions.
- Work Practice Controls: Controls that reduce the likelihood of exposure by altering the manner in which a task is performed.
- Universal Precautions: An approach to infection control. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other bloodborne pathogens.

#### D.13.2 Exposure Control Plan:

Due to the hazardous nature of UXO work there is the potential for accidents and the exposure to bloodborne pathogens. USA employees will be required to perform emergency first aid and/or CPR in the event of an accident or injury and universal precautions will apply. A minimum of two employees will be first aid and CPR trained.

### D.14 STANDARD SAFE WORK PRACTICES

All personnel on-site will be required to follow the SWPs contained in the following paragraphs and will immediately report to the UXOSO any conditions which do not comply with these paragraphs. The provisions outlined in these paragraphs are intended to be the minimum SWPs that site personnel will follow:

- Avoid contact with potential hazards, unidentified metal objects, or contaminated substances.
- All site personnel should be alert to all potentially dangerous situations (e.g., presence of UXO or OE related items).
- Site personnel shall be familiar with the physical characteristics of the operation, including:
  - accessibility to personnel, equipment, vehicles, communication; and
  - site access.
- Protective equipment as specified in this SSHP will be used.
- Wearing PPE can result in an impairment of the ability to operate site equipment. All site personnel should pay specific attention to decreased performance capabilities resulting from the use of PPE.
- Wearing of jewelry, such as rings and loose bracelets and necklaces, is prohibited when shown it may contribute to a hazard.
- Portable containers used to dispense drinking water shall be capable of being tightly closed, and equipped with a tap. Water shall not be dipped from containers. Where single service cups (to be used but once) are supplied, both a sanitary container for the unused cups and a receptacle for disposing of the used cups shall be provided.
- Buddy system procedures will be enforced during site operations.
- Site personnel will perform only those tasks that they are qualified for and feel they may safely perform.
- Running and horseplay are prohibited in all areas of the site.

## **D.15 POWER AND HAND TOOL OPERATION**

### **D.15.1.1 Power Tools**

All personnel on-site will follow the requirements of EM 385-1-1, section 13, the manufacturer's instructions and recommendations and the SWPs contained in this paragraph and the work plan, and will immediately report to the UXOSO any conditions which do not comply with this paragraph. Power tools must be manufactured by companies with a listing by an accepted testing laboratory. The provisions outlined in this paragraph are intended to be the minimum SWPs which site personnel will follow.

- Operation will be conducted by authorized personnel familiar with the tool, its operation, and safety precautions;
- Power tools will be inspected by the user prior to use and on a continued periodic basis by the UXOSO or Team Leader, and defective equipment will be tagged and removed from service until repaired or replaced;
- Alterations, modifications, or additional attachments are not authorized unless approved by the manufacturer;
- Power tools designed to accommodate guards will have such guards properly in place prior to use;
- Loose fitting clothing or long hair will not be permitted around moving parts;
- Hands, feet, etc., will be kept away from all moving parts;
- Maintenance and/or adjustments to equipment will not be conducted while it is in operation; the power will be disconnected prior to maintenance activities;
- An adequate operating area will be provided, allowing sufficient clearance and access for operation;
- Personnel will use required protective equipment, such as safety glasses, hearing protection, gloves, chaps, and/or shin guards when using chainsaws and weed eaters.

**D.15.1.2 Hand Tools**

Use of improper or defective tools can contribute significantly to the occurrence of accidents on site. Therefore, the requirements outlined in EM 385-1-1, section 13, the manufacturers instructions and recommendations and the safe work practices listed below shall be observed when using hand tools:

- Hand tools will be inspected for defects by the user prior to each use and on a continued periodic basis by the UXOSO or the Team Leader;
- Defective hand tools will be tagged and removed from service and repaired or properly discarded;
- Tools will be selected and used in the manner for which they were designed;
- Be sure of footing and grip before using any tool;
- Do not use tools that have split handles, mushroom heads, worn jaws, or other defects;
- Gloves will be worn to increase gripping ability and/or if cut, laceration or puncture hazards exist during the use of hand tools;
- Safety glasses or a face shield will be used if use of tools presents an eye/face hazard;
- Do not use makeshift tools or other improper tools;
- When working overhead, tools will be secured to ensure they cannot fall on someone below;
- Use non-sparking tools in the presence of explosive vapors, gases, or residue.

#### D.16 MATERIAL LIFTING

Many types of objects are handled in normal day-to-day operations. Care should be taken in lifting and handling heavy or bulky items because they are the cause of many joint and back injuries. The requirements found in EM 385-1-1, section 14 and the following fundamentals address the proper lifting of materials to avoid joint and back injuries:

- The size, shape, and weight of the object to be lifted must be considered. Site personnel will not lift more than they can handle comfortably;
- A firm grip on the object is essential, therefore the hands and object shall be free of oil, grease and water, which might prevent a firm grip;
- The hands, and especially the fingers shall be kept away from any points that cause them to be pinched or crushed, especially when setting the object down;
- The item will be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces and pinch points, and gloves shall be used, if necessary, to protect the hands;
- Use powered or mechanical lifting devices whenever possible;
- The feet will be placed far enough apart for good balance and stability;
- Personnel will ensure that solid footing is available prior to lifting the object;
- When lifting, get as close to the load as possible, bend the legs at the knees, and keep the back as straight as possible;
- To lift the object, the legs are straightened from their bending position;
- Never carry a load that you cannot see over or around;
- When placing an object down, the stance and position are identical to that for lifting: with the back kept straight and the legs bent at the knees, the object is lowered; and

- If needed, USA will provide back support devices to their personnel to aid in preventing back injuries during lifting activities.
- When two or more people are required to handle an object, coordination is essential to ensure that the load is lifted uniformly and that the weight is equally divided between the individuals carrying the load. When carrying the object, each person, if possible, shall face the direction in which the object is being carried.

## D.17 FIRE HAZARDS

### D.17.1 Causes of Fires and Explosions

Although fires and explosions may arise spontaneously, they are more commonly the result of carelessness during the conduct of site activities, such as moving drums, mixing/bulking of site chemicals and during refueling of heavy or hand held equipment. Personnel will review EM 385-1-1, section 9 for fire prevention and protection measures. Some potential causes of explosions and fires include:

- Mixing of incompatible chemicals, which cause reactions that spontaneously ignite due to the production of both flammable vapors and heat;
- Ignition of explosive or flammable chemical gases or vapors by external ignition sources;
- Ignition of materials due to oxygen enrichment;
- Agitation of shock or friction-sensitive compounds;
- Sudden release of materials under pressure;
- Smoking in unauthorized areas.

### D.17.2 Fire Prevention

Explosions and fires not only pose the obvious hazards of intense heat, open flames, smoke inhalation, and flying objects, but may also cause the release of toxic chemicals into the environment. Such releases can threaten both personnel on-site and members of the general public living or working nearby. Site personnel involved with potentially flammable material or operations will follow the guidelines listed below and in EM 385-1-1 section 09.B to prevent fires and explosions:

- Potentially explosive/flammable atmospheres involving gases or vapors will be monitored using a combustible gas indicator;
- Prior to initiation of site activities involving explosive/flammable materials, all potential ignition sources will be removed or extinguished;
- Non-sparking and explosion-proof equipment will be used whenever the potential for ignition of flammable/explosive gases/vapors/liquids exists;
- Dilution or induced ventilation may be used to decrease the airborne concentration of explosive/flammable atmospheres;
- Smoking is prohibited at OE/UXO work sites, or in the vicinity of, operations that may present a fire hazard. The area will be conspicuously posted with signs stating "No Smoking or Open Flame Within 50 Feet";

- Flammable and/or combustible liquids must be handled only in approved, properly labeled metal safety cans equipped with flash arrestors and self-closing lids;
- Transfer of flammable liquids from one metal container to another will be done only when the containers are electrically interconnected (electrically bonded);
- The motors of all equipment being fueled will be shut off during the fueling operations;
- Equipment fueling points will be located at an approved location and safe distance from ongoing operations and will have spill containment/absorbent material available;
- Equipment fueling points will have fire extinguisher(s) properly located and ready for use;
- Metal drums used for storing flammable/combustible liquids will be equipped with self-closing safety faucets, vent bung fittings, grounding cables and drip pans, and will be stored in an area approved by the UXOSO.

**D.17.3 Fire Protection**

The following safe work practices will be used to protect against fires:

- Vehicles and equipment will not be fueled while running;
- Flammable/combustible liquid storage areas will have at least one 3A:40B:C fire extinguisher located within 25-75 feet, marked with the appropriate fire symbol and no smoking signs;
- Temporary offices will be equipped with a fire extinguisher of not less than 2A:20B:C;
- At least one portable fire extinguisher having a rating of not less than 2A:20B:C will be located at each work site.

**D.18 EXCAVATIONS**

Excavation activities will be conducted in accordance with EM 385-1-1, section 25, 29 CFR 1926, and the USA SHP. The guidelines below are intended to reflect minimum requirements to be followed on this site:

- Prior to initiation of any excavation or trenching activity, the location of underground installations will be determined if applicable;
- When the excavation/trench achieves a depth of greater than four (4) feet, a competent person (as defined by OSHA 29 CFR 1926.650 (b)) will take prompt corrective measures to identify and eliminate hazards associated with the excavation;
- The excavation(s) will be inspected daily by a competent person prior to commencement of work activities;
- Evidence of cave-ins, slides, sloughing, or surface cracks will be cause for work to cease until necessary precautions are taken to safeguard workers;
- Excavations five (5) feet or deeper, which cannot be sloped at a 1.5 to 1 ratio, will require a competent individual to design and install a protective system;
- Protective systems shall be selected from OSHA 29 CFR 1926 Subpart P and/or designed by a registered professional civil engineer;

- Spoils and other materials will be placed two (2) feet or more from the edge of the excavation;
- Materials used for sheeting, shoring, or bracing will be in good condition.
- Timbers will be sound, free of large or loose knots, and of appropriate dimensions for the excavation;
- Safe access will be provided into the excavation(s) by means of a gradually sloped personnel access/egress ramp, or ladders or stairs will be provided;
- Ladders used will extend three (3) feet. above grade level and be secured from movement.
- Excavations four (4) feet. or more in depth will have a means of egress at a frequency such that lateral travel to the egress point does not exceed twenty five (25) feet.;
- Walkways or bridges with standard guardrail will be provided where employees are required or permitted to cross over excavations;
- If the depth of an excavation is greater than four (4) feet, it will be inspected by the UXOSO to determine if it meets the criteria for a confined space;
- If an excavation is determined to be a Confined Space the requirements set forth in the 29 CFR 1910.146 will apply;

IAW the requirements of 29 CFR 1926.651(g), if an excavation is greater than four (4) feet in depth, and the potential for having a hazardous atmosphere inside the excavation exists, then the atmosphere shall be tested often for oxygen deficiency, flammability's and toxicity prior to entry by site personnel.

If an excavation meets all three (3) of the criteria listed below, it must be defined as a confined space, and the provisions and safety precautions of the USA SSHP will apply.

- It is large enough and so configured that an employee can bodily enter and perform assigned work;
- Is not designed for continuous human occupancy;
- Has limited or restricted means for entry or exit.

To avoid classifying an excavation as a confined space, it is imperative that one of the requirements listed above be removed or avoided. The easiest requirement to remove is the one related to limited means of entry and exit. Entry/exit points must be designed and maintained which allow for easy entry and exit from the excavation. This can be accomplished through the construction of gently sloping entry and exit ramps which are located such that lateral travel to an exit is no greater than 25 feet from the work area in the excavation. If this cannot be accomplished, then the excavation must be classified as a confined space and the appropriate safety precautions implemented and a confined spaces program instituted.

## D.19 PERSONAL PROTECTIVE EQUIPMENT

### D.19.1 General

PPE required at the site will be at a level necessary to protect personnel and IAW EM 385-1-1, Section 5. During operations a hard hat is not required unless a possible head injury could result from the use of equipment or overhead hazards. Steel toe footwear will not be used while operating magnetometers or geophysical instruments. Personnel working in the established work zones will be required to wear OSHA Level D protection. This will consist of at a minimum:

- Standard work clothes with long pants and shirts with short or long sleeves as appropriate;
- Sturdy work boots for site personnel. Boots without steel toe or shank will be used by the geophysical prove-out and UXO teams due to interference with geophysical instruments; and
- Additional items may include safety glasses, hearing protection, work gloves, and hard hat as required.

Personnel working away from established work zone areas will not be required to wear the PPE listed above.

### D.19.2 Personal Protective Equipment (PPE) Program:

- PPE Selection: Level D for normal conditions. PPE shall be evaluated for newly identified hazards, tasks, or changing site conditions.
- PPE Use and Equipment Limitations: No known atmospheric hazard; work tasks preclude splashes, immersion and potential for unexpected inhalation/contact with chemical hazards.
- Work Mission Duration: Site Project Manager/SUXOS/UXOSO Instructions.
- PPE Maintenance and Storage: N/A
- PPE Decontamination and Disposal: N/A
- PPE Training/Fitting: As Necessary.
- PPE Donning and Doffing: As Necessary.
- PPE Inspection: Site Manager/SUXOS/UXOSO Instructions.
- PPE Program Effectiveness: N/A; Level D only.
- PPE Temperature Limitations: Thermal Stress monitoring recommendations.

When site conditions warrant, additional protective clothing will be worn (e.g., working in hot or cold weather conditions wear proper gear, including gloves and boots).

### D.19.3 Personnel And Equipment Decontamination

All intrusive activities will be conducted using approved methods. No Hazardous, Toxic, or Radiological Waste (HTRW) materials are expected to be encountered in the maneuver area and therefore decontamination for HTRW constituents will not be necessary other than for normal hygiene. Should HTRW constituents be encountered at action levels a decontamination plan will be implemented.

## D.20 PERSONAL HYGIENE AND DECONTAMINATION

Site sanitation will be established and maintained IAW 29 CFR 1910.120(n) and EM 385-1-1, section 2.

- Necessary facilities and their locations: To be determined at site by number of personnel and location.
- Decontamination SOPs: N/A

**D.20.1 Potable Water Supply**

An adequate supply of potable (drinkable) water, coolers, and ice will be provided on site at all times in accordance with 29 CFR 1910.120 (n) (1) and EM 385-1-1, section 2, A. Personnel are encouraged to drink water at frequent intervals. Potable water will also be used for the washing of the person (i.e. face, hands, neck).

**D.20.2 Non-Potable Water**

Containers of water, clearly marked non-potable water, will be available to teams for washing off/cleaning equipment in accordance with 29 CFR 1910.120 (n) (2) and EM 385-1-1, section 2, A. Non-potable water will not be used as a substitute for potable drinking water. Non-potable water will not be used for the washing of skin surfaces of personnel.

**D.20.3 Toilet Facilities**

Established toilet facilities will be utilized on site if available. If established facilities are not available, portable toilet facilities will be made available (on-site). The number and type of facilities will be in accordance with 29 CFR 1910.120 (n) (6) and EM 385-1-1, section 2, B. Personnel will use toilet facilities in order to maintain sanitary site conditions.

**D.20.4 Washing Facilities**

Hand and face washing facilities are available at the site support vehicles, and will be utilized by all personnel during breaks or upon exiting the EZ prior to eating, drinking, tobacco use, or other hand to face activities. Washing facilities in the EZ will consist of potable water containers, buckets, soap, and drying towels. These facilities will be in accordance with EM 385-1-1, section 2, C.

**D.20.5 Equipment Decontamination**

- Decontamination facilities/locations: N/A
- Decontamination procedures: N/A

**D.21 SITE CONTROL****D.21.1 General Site Access Controls**

USA will be conducting operations on land located within the Waikoloa Maneuver Area. Access to this area will be controlled. All personnel on-site will follow the guidelines of this SSHP.

- Work zones and access points: Site access control will be implemented by the UXOSO and will be accomplished through a program that limits movement and activities of personnel and equipment at the project site. Personnel will follow and enforce site access control procedures.
- Site map delineating work zones: A site map will be used during the Tailgate Safety Briefings to inform the workers of the location of hazardous areas on the site, the assembly areas to be used in the event of a site evacuation, route to be taken, and any other information relevant to the day's activities.
- Ionizing radiation restricted areas: N/A
- Site security (physical and procedural) description:
  - It is anticipated that the project personnel will provide security on the site.
  - General site access description: Limited roadways in the area.

## **D.21.2 Communications**

### **D.21.2.1 On-Site Communications**

On-site communications will be used to communicate information pertaining to safety, operations, and emergencies. On-site communications will be achieved orally with a contingency for hand signals, or on-site cellular phone / FM two-way radio.

### **D.21.2.2 Off-Site Communications**

Cellular phones will be available to the Site Project Manager, SUXOS, UXOSO, and UXOQCS to contact emergency response organizations if needed (EMS, Fire Department, Police, etc.). Operations will not commence unless and until off-site communications are available.

## **D.21.3 Training**

### **D.21.3.1 Personnel Training**

All USA personnel performing field activities on-site have received 40 hours of initial OSHA health and safety training in accordance with the provisions of 29 CFR 1910.120(e). USA's personnel have also received 8 hours of refresher training or Supervisors refresher training on an annual basis as needed. Selected USA field personnel are also appropriately trained in first aid and cardiopulmonary resuscitation (CPR). At least two personnel trained in first aid and CPR will be present on-site during field operations IAW 29 CFR 1910.151(b). Re-certification in first aid will be accomplished every 3 years and re-certification for CPR will be annually IAW the American Red Cross Standards. All training records are kept on file at the employee's home office. Copies of training certificates will be provided to the UXOSO.

### **D.21.3.2 Site-Specific Training**

The UXOSO is responsible for developing a site-specific occupational hazard training program. This training will take place prior to the commencement of work and for the duration necessary to complete the required training. The UXOSO is responsible for providing training to all on-site personnel. This training will cover the following topics:

- Names of personnel responsible for site safety and health;
- Safe work practices;
- Site history;
- Safety, health, and other hazards at the site;
- Work zones, support zones, and other locations;
- Emergency procedures, evacuation routes, emergency phone numbers;
- Proper use, maintenance, and storage, of PPE;
- Safe use of engineering controls and equipment on site; and
- Prohibitions in areas and zones, including: site layout and procedures for entry and exit or work areas and zones.

**D.21.4 Daily Safety Meetings**

The UXOSO will conduct daily safety meetings to review the safety procedures for the planned activities. Team leaders will conduct task specific “tailgate” safety briefing prior to commencing work. The daily meetings will address:

- Activities planned for the day;
- Associated safety issues and specific hazards;
- Emergency notification procedures and phone numbers;
- Rally points and safe areas;
- Evacuation routes; and
- Emergency equipment.

**D.22 MEDICAL SURVEILLANCE**

All USA personnel performing on-site field activities participate in an ongoing medical surveillance program in accordance with 29 CFR Part 1910.120(f). USA utilizes the services of a licensed occupational health physician to provide the medical examinations and surveillance. The content of the examination is designed to determine each individual's fitness for duty, including ability to work while wearing protective equipment (e.g., respirator, impermeable clothing, etc.). The results of these examinations are kept on file for 30 years after employment has been terminated.

All USA personnel who will be performing on-site field activities for this project will present to the UXOSO a occupational health physician's certification of completion of a comprehensive medical monitoring examination dated within the 12 months prior to the beginning of field activities. Additionally, the UXOSO will ensure that workers remain current in their medical monitoring throughout the duration of the project. Examinations will be scheduled so an overlap of medical coverage is obtained for the individual. The certification shall attest to the individual's fitness for duty, including his or her ability to work while wearing protective equipment (e.g., respirator, impermeable clothing, etc.). Copies of employees' Health Status Reports will be available to the Contracting Officer upon request.

**D.22.1 Dosimetry**

- Safety and health issues involving employees working within a restricted area containing radiation or activities that will generate worker exposure in excess of what is considered acceptable levels of radiation to the general public are beyond the scope of this SSHP.
- Radiation dosimetry: N/A
- Employee radiation exposure history: N/A
- Internal radioactive contamination exposure hazards are beyond the scope of this SSHP.
- Reports of Exposure to Ionizing Radiation: N/A

**D.22.2 Exposure Monitoring/Air Sampling Program**

- Air Monitoring/Air Sampling: N/A
- Real-time Screening for Ionizing Radiation: N/A
- Sampling and analytical methods: N/A
- Sample analysis laboratories: N/A
- Meteorological data: N/A
- Noise monitoring: N/A
- Monitoring/sampling results: N/A
- Exposure monitoring records: N/A

**D.23 ACCIDENT PREVENTION**

All field personnel receive site-specific health and safety training before starting any site activities. On a day-to-day basis, individual personnel should watch for indicators of potentially hazardous conditions and exposures. Emergencies can be averted by rapid recognition and notification of dangerous situations or conditions. Before assigning daily tasks, daily tailgate safety meetings will be held by the team leader and may be monitored by the UXOSO.

The site management supervises site personnel to ensure they are meeting health and safety requirements. If deficiencies are noted, work is stopped and corrective action is taken (e.g., re-train, correct/change procedures). Reports of health and safety deficiencies and the corrective action(s) taken will be forwarded to the Project Manager and Safety and Health Manager.

**D.24 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES****D.24.1 Introduction**

If an emergency develops on-site, the procedures delineated herein are immediately followed. Emergency conditions exist if:

- Any member of the team is involved in an accident or experiences any adverse effects or symptoms of exposure;
- A condition occurs that is more hazardous than anticipated; and/or;
- Fires, explosions, and/or unusual weather conditions (thunderstorms, lightning, high winds, etc.) occur.

If an emergency occurs, direct voice communication is used to sound the alarm. If personnel are out of range of direct voice communication, an air horn or vehicle horn will be sounded for 12 to 15 seconds. Notify the site of the emergency by radio or cell phone. General emergency

procedures and specific procedures for personal injury are described within this section. Table 8.8 is a list of emergency contacts.

#### **D.24.2 General Emergency Procedures**

The emergency procedures are as follows:

- Alert project personnel immediately of the type and location of the emergency. Cease operations and await instructions.
- Notify the contact listed in Table D-7 when an emergency occurs. This list will be posted prominently at the site.
- Use the “buddy” system (pairs) during all field activities.
- Maintain visual contact between the “pairs.” Each team member remains close to the other to assist in case of emergencies.
- If any member of the team experiences any adverse effects or symptoms of exposure, the entire team will immediately halt work and act according to the instructions provided by the UXOSO or. SUXOS
- Any condition that suggests a situation is more hazardous than anticipated will result in evacuating the team and re-evaluating the hazard and the level of protection required.

If an accident occurs, the UXOSO will perform accident reporting and recordkeeping in accordance with OSHA 29 CFR Part 1904, AR 385-40 with USACE Supplement 1, ENG Form 3394, and EM 385-1-1. A completed copy of the ENG Form 3394 will be submitted to the USAESCH Safety Office within 24 hours of the accident.

#### **D.24.3 Emergency Equipment and First Aid Requirements.**

- First aid equipment and supplies: A First Aid Kit (16 unit minimum) will be kept at the work location in a designated vehicle.
- Emergency eye washes/showers: Emergency eyewash solution is located in the Large Team 1<sup>st</sup> Aid Kit, maintained onsite.
- Emergency-use respirators: N/A
- Spill control materials and equipment: As needed for limited spill response.
- Material Safety Data Sheets: See Attachment 4.
- Fire extinguishers: One 2A:10B:C fire extinguisher will be provided per vehicle.
- Local fire/police/rescue pre-notification: Notifications by UXOSO during site preparation.
- Emergency Response Plan:
  - (1) Pre-emergency planning and procedures for reporting incidents to appropriate government agencies: As specified and prearranged by the UXOSO.
  - (2) Personnel roles, lines of authority, communications:

- Principle Personnel (See Table D-1 )
- Lines of Authority (See Figure D-1)
- Personnel Responsibilities (See Table D-1)
- Project Manager (See Table D-1)
- Certified Industrial Hygienist (See Table D-1)
- Corporate Safety Manager (See Table D-1)
- Nearest Trauma Medical Facility (See Figure D-6)
- Ambulance: (See Table D-7)
- Police: (See Table D-7)
- Fire: (See Table D-7)
- Poison Control Center: (See Table D-7)

(3) Emergency recognition and prevention: The site shall be evacuated in the event significant unexpected hazards are encountered which are beyond the scope and capabilities of site personnel to properly evaluate and contain.

(4) Site topography, layout, and prevailing weather conditions:

- Site Topography (See WP).
- Layout. (See WP).
- Prevailing Weather Conditions: The Waikoloa Maneuver Area project location is subjected to hot summers and mild winters. Proper monitoring of weather conditions will be required to ensure worker safety from potential thermal stress conditions caused by extremes.

(5) Criteria and procedures for site evacuation (emergency alerting procedures/employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).

- Emergency Alerting Procedures/Alarm System: Oral Communication for small groups; emergency signals for large groups (e.g., air/vehicle horns); and radios or cell phones for site wide communications as specified by the UXOSO.
- Emergency PPE and Equipment.
- Safe Distances: As specified by the UXOSO, as determined by the MPM or task being performed.
- Places of Refuge: As specified by the UXOSO.
- Evacuation Routes: As specified by the UXOSO.
- Site Security and Control (See paragraph D.21): As specified by the UXOSO.

(6) Specific procedures for decontamination and medical treatment of injured personnel: Decontamination procedures are not anticipated for this EE/CA. Medical injuries that cannot be treated utilizing the on-site first aid kit will be handled by the nearest medical facility.

(7) Route maps to nearest pre-notified trauma medical facility: See Figure D-6.

(8) Criteria for initiating community alert program, contacts and responsibilities: As determined by USACE personnel.

(9) Critique of emergency responses and follow-up will be IAW 29 CFR 1910.38(a).

**D.24.4 Emergency Procedures**

Emergency response procedures include all steps to be taken for notifying, evaluating, reacting to, documenting and following-up on a given emergency situation. To ensure all necessary elements are covered, the procedural steps outlined in this paragraph will be implemented for each emergency, regardless of its nature.

**D.24.5 Notification**

Once the OSIC has been informed of the emergency, the OSIC will alert site personnel to the presence of the emergency by radios. This will be done in order to:

- Notify personnel and to get their attention;
- Stop all work activity as required;
- Lower noise levels in order to speed and simplify communication;
- Begin emergency and/or evacuation procedures.

If on-site USA personnel or off-site emergency personnel are to enter the site in response to the emergency, the OSIC will, to the extent possible, notify the response personnel about the nature of the emergency, to include:

- What happened and when it happened;
- Where on-site the emergency situation occurred;
- Who is involved and, if possible, the cause of the emergency;
- The extent of damage and what hazards may be involved; and
- What actions should be taken?

**D.24.6 Assessing the Emergency**

Available information related to the emergency and the on-site response capabilities should be evaluated and the information listed below obtained to the extent possible:

- What happened;
- Type of incident;
- Casualties involved:
- Victims (number, location and condition);
- Treatment required;
- Missing personnel;
- Cause of incident;
- Extent of damage to structures, equipment and terrain;
- What could happen from this point; consider;
- Potential for fire or explosion;
- Location of all personnel in relation to hazardous areas;
- Potential for the emergency affecting the general public or the environment;
- Equipment and personnel needed for rescue and hazard mitigation;
- Number of uninjured personnel available for response;
- Resources available on-site;
- Resources available from off-site response groups and agencies;
- Time needed for off-site response resources to reach the site; and
- Hazards involved in rescue and response.

#### **D.24.7 Rescue and Response Actions**

Based on the information collected during the emergency assessment, the general actions listed below will be taken, with some actions being conducted concurrently. No one will attempt emergency response/rescue until the situation has been assessed and the appropriate response outlined by the OSIC.

- Enforce the Buddy System:
  - Allow no one to enter a hazardous area without a partner.
  - Personnel in the EZ should be in line-of-sight or in communication with the OSIC or his designee.
- Survey Casualties:
  - Locate all victims and assess their condition.
  - Determine resources needed for stabilization and transport.
  - Assess Existing and Potential Hazards and Determine;
  - Whether and how to respond.
  - The need for evacuation of site personnel and off-site population.
  - The resources needed for evacuation and response.
- Request Aid:
  - Contact the required off-site/on-site personnel or facilities (EMS), ambulance, fire department, police, etc.
- Allocate Resources:
  - Allocate on-site personnel and equipment to rescue and initiate incident response operations.
- Control the site:
  - Assist in bringing the hazardous situation under complete or temporary control and use measures to prevent the spread of the emergency, i.e. control fire, secure site, etc.
- Extricate:
  - Remove or assist victims from the area.
- Stabilize:
  - Administer any medical procedures that are necessary before the victims can be moved.
  - Stabilize or permanently fix the hazardous condition.
  - Attend to what caused the emergency and anything damaged or endangered by the emergency (e.g., drums, tanks).
- Transport:
  - Using either on-site or off-site assets.
  - Casualty Logging;
  - Record who, time, destination and condition upon transport.
- Evacuate:
  - Move site personnel to the rally point, a safe distance upwind of the incident.
  - Monitor the incident for significant changes; the hazards may diminish, permitting personnel to re-enter the site, or hazards may increase and require public evacuation.
- Casualty Tracking:
  - Record disposition, condition and location.

**D.24.8 Post Emergency Follow-Up**

Before normal site activities can resume, the site and personnel must be prepared and equipped to handle another emergency. It is also imperative that all Federal, state and local regulatory agencies be notified of the emergency. Therefore, the following activities must be conducted prior to re-start of site activities:

- Notify all appropriate governmental agencies as required (i.e. OSHA must be notified if there have been any fatalities or three or more personnel hospitalized);
- Restock and clean all equipment and supplies utilized or damaged in the emergency; \*
- Conduct an accident investigation to determine the cause of the emergency and what preventative measures could be taken to ensure the emergency does not occur again; \*
- Complete the USA accident form, insurance forms and Eng Form 3394 as directed;
- Review and revise, as needed, the site operational procedures, and if necessary update the SSHP to reflect the new procedures.

\* To be accomplished prior to re-starting site activities

**D.24.9 Documentation**

Documentation related to the emergency will be recorded in an accurate, descriptive and complete manner. Documentation shall be recorded as soon as possible after the emergency to ensure it is recorded while the events are vivid in the minds of those personnel involved. The information recorded will include:

- A chronological record of events;
- A listing of the personnel involved, including personnel on-site, site personnel who responded, personnel in charge, and off-site groups or agencies that responded;
- A listing of the actions taken to minimize the effects of or mitigate the emergency;
- An assessment of the potential exposures received by site personnel and the surrounding public; and
- A recording of the injuries or illnesses that occurred as a result of the emergency.

**D.24.10 Directions and Emergency Contacts**

Figure D-6. Hospital Location Map Medical Treatment Facility for Waikoloa Maneuver Area



- Directions To Kailua Kona Medical Facility
- Exit work area onto either Hwy 19 or Hwy 190 as appropriate.
- Proceed south to Kailua Kona.
- Exit onto Palani road, proceed to Kuakini Hwy and turn left, proceed south.
- Exit right onto Hualalai road, Straub hospital is located ahead.

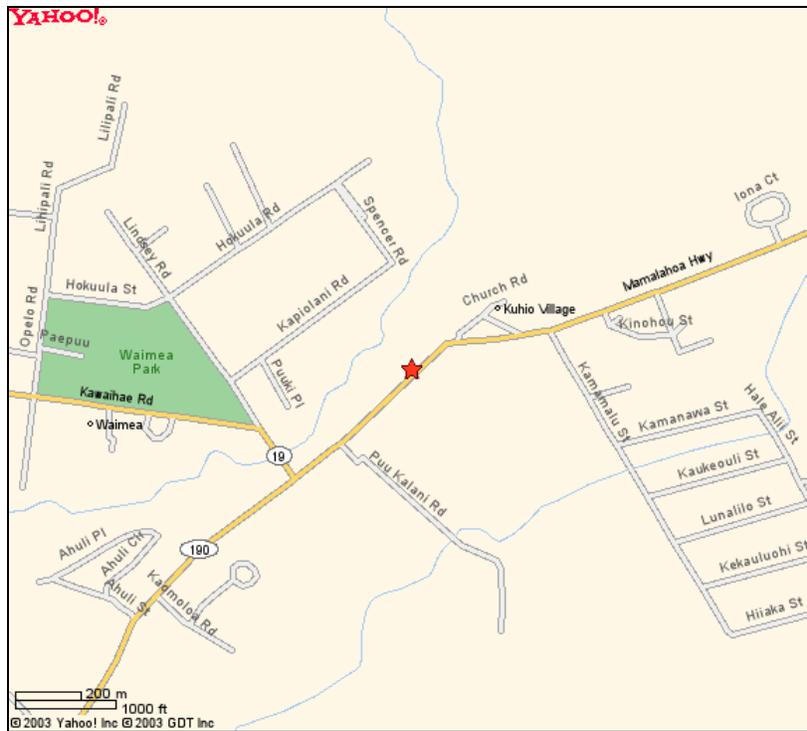
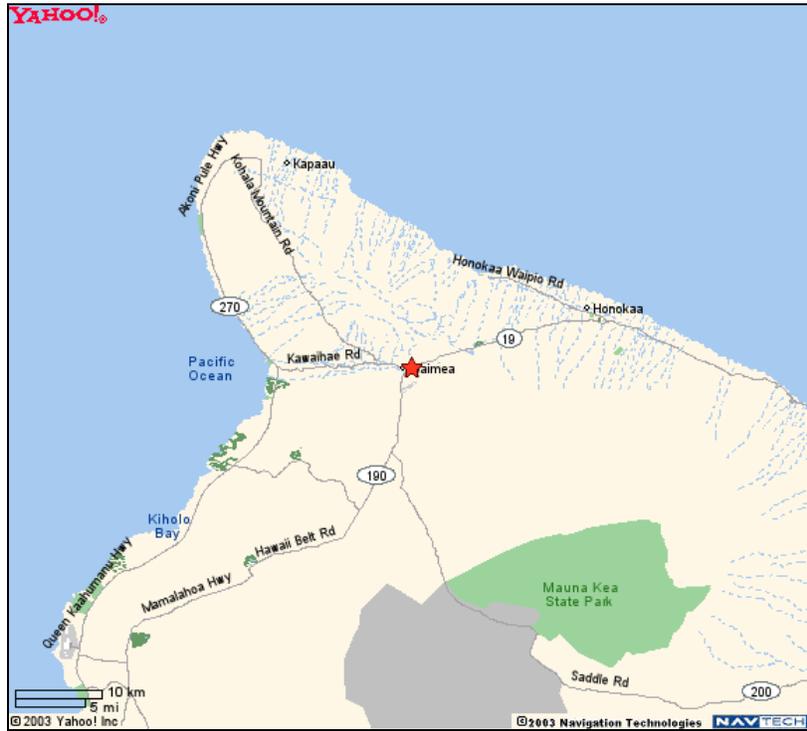


Figure D-7. North Hawaii Community Hospital  
Closest Non-Trauma Hospital to Waikoloa Maneuver Area

**Located in: Kamuela, 67-1125 Mamalahoa Highway**

Hours: **24-hrs./day**

Mailing: **67-1125 Mamalahoa Highway, Kamuela, HI 96743**

Contact: **John McNeil, CEO**

Phone: **(808) 885-4444**

Fax: **(808) 881-4624**

Email: **[mcneiljm@nhawaiiipo.ah.org](mailto:mcneiljm@nhawaiiipo.ah.org)**

Website: **[www.planet-hawaii.com/nhch](http://www.planet-hawaii.com/nhch)**

**Directions**

DIRECTIONS	DISTANCE
1: Start out going Southeast on WAIKOLOA RD toward HI-190/ MAMALAHOA HWY/ HAWAII BELT RD.	6.39 miles
2: Turn RIGHT onto HI-190/ MAMALAHOA HWY/ HAWAII BELT RD.	3.47 miles
<b>Total Estimated Time:</b>	<b>Total Distance:</b> 9.86 miles
16 minutes	

These contacts (Table D-7) will be posted prominently at the site. Should any situation or unplanned occurrence require outside assistance or support services, the appropriate contact from the following list should be made.

Table D-7. Emergency Contacts

<u>Agency</u>	<u>Telephone Number</u>
Emergency: Fire/Police/Ambulance	911
North Hawaii Community Hospital	(808) 885-4444
Straub Hospital, Kona	(808) 329-9211
Poison Control Center	(800) 222-1222
CHEMTREC	(800) 424-9300
USAESCH Safety Office	(256) 895-1582
<u>Responsible Person</u>	<u>Telephone Number</u>
USAESCH PM	(256) 895-1507
USACE POH District PM	(808) 438-6934
USACE OE Safety Specialist	TBD
USA Environmental, Inc. PM	(813) 884-5722 x119
USA Environmental, Inc. Safety and Health Manager	(813) 884-5722 x140

**D.24.11 Procedures Implemented for a Major Fire or Explosion**

If a major fire, explosion or on-site health emergency crisis occurs on-site, the UXOSO shall:

- Refer to the appropriate paragraph of this SSHP;
- Notify Emergency Teams, as necessary;
- Signal the evacuation procedure previously outlined and implement the entire procedure;
- Isolate the area;
- Stay upwind of any fire;
- Keep area surrounding the problem source clear after the incident occurs; and
- Complete an accident report form and distribute to appropriate personnel.

**D.25 LOGS, REPORTS AND RECORD KEEPING****D.25.1 Logbook**

The Site Manager will keep a log recording the following aspects related to safety at the site:

- Training (initial site specific training, tailgate meetings, etc);
- Site visitors;
- Issues or problems encountered;
- Accidents; and
- Emergencies.

**D.25.2 Safety Log**

The UXOSO will maintain a daily safety log of all safety related activities. The following information will be maintained in the Safety Log:

- Date and recorder of log;
- Tailgate safety briefing (time conducted, material discussed, etc.);
- Weather conditions;
- Significant site events relating to safety;
- Accidents;
- Stop work events related to safety;
- Safety audits; and
- Signature of the UXOSO indicating concurrence.

**D.25.3 Training Log**

The UXOSO will maintain a training log documenting the following information:

- Date and recorder of log;
- Nature of training (personnel will complete the appropriate documentation of training form);
- Visitor training; and
- Signature of the UXOSO and SUXOS.

**D.25.4 Equipment Maintenance Log**

The UXOSO will document all information related to safety equipment maintenance, calibration, and standardization in the Safety Log or Safety Inspection Record.

**D.25.5 Visitor Log**

The UXOSO will be responsible for maintaining the visitor's log that will be used to record the entry and exit of all visitors, including Federal, state or local officials who visit the site. This log will reflect name, organization, date and time of visitor entry/exit. Visitors will be briefed on:

- The Waikoloa Maneuver Area SSHP;
- Restricted and safe areas;
- Site hazards and risks to include OE, biological, heat/cold, and trip hazards;
- PPE requirements and use;
- Fire and OE safety requirements;
- Site evacuation and emergency procedures.

**D.25.6 Record keeping**

The UXOSO will establish and maintain a filing system on-site for Safety and Health records, reports, and information concerning individual training, medical surveillance, etc. Sections in this filing system will include:

- Training Records -- Certificates for training required by 29 CFR1910.120 (40-hour initial HAZWOPER, 8-hr refresher, and supervisory training) will be maintained at the site. Additionally, documentation of CPR and First Aid training will be available at the site.
- Medical Monitoring -- Documentation of current enrollment (within last 12 months) in a medical monitoring program will be available for each employee working at the site. Documentation will consist of the employee's Health Status Report that is written and signed by the examining physician.
- Accident Reports -- Copies of any accident/incident reports and follow-up reports.
- Plan Acceptance Forms -- Copies of the Plan Acceptance Forms documenting that employees have read and understand the SSHP will be maintained at the site.

**D.25.7 Accident Reports**

If an injury or illness occurs on-site, the UXOSO is responsible for completing a USA Accident Report form. The UXOSO will coordinate preparation of the respective forms to ensure accuracy and consistency. The UXOSO must submit a copy of this form to the Safety and Health Manager within 24-hours of the injury. All accidents/incidents must be investigated by the UXOSO. The purpose of the investigation is to determine the causal factors that lead to the accident/incident and to establish corrective actions to prevent a recurrence. A completed USA Accident Report Follow-Up Form must be forwarded to the Safety and Health Manager within 7 days after the incident.

ENG. Form 3394 will be completed and forwarded within 24 hours for those injuries meeting the reporting requirements of AR 385-40 with USACE Supplement 1. All accidents will be reported and investigated to determine the cause of the accident and develop controls to prevent recurrence. Notification and reporting will be in accordance with AR 385-40, Accident Reporting and Records, and USACE Supplement 1 to AR 385-40.

OSHA recordable injuries and/or illnesses will be entered on the OSHA Form 300 by the UXOSO. This form will be maintained onsite for the duration of the project.

**D.26 SITE HOUSEKEEPING**

All work areas will be maintained in a clean/neat fashion, free of loose debris and scrap. Any materials/equipment not being used will be removed and stored or disposed of accordingly. All work areas will be supplied with a trash receptacle with lid or bag as appropriate, the contents of which will be emptied/disposed of daily.

**D.27 ILLUMINATION**

Personnel will only work during the hours of daylight, and no field activities will be scheduled during the period of thirty minutes before dusk or thirty minutes after dawn.

**D.28 COMMUNICATIONS**

On and off site communications will be provided using radios and cellular telephones. Radio communications are provided to site personnel or teams. Communication of evacuation routes and assembly points will occur daily during the tailgate safety briefing. All communications will be tested daily. When emergency services are requested from any agency, the caller will remain available to provide information and directions to responding personnel.

**D.28.1 Off-Site Communications**

Off-site communication will be available at all times. Site operations will not be conducted unless off-site communications are available. Off-site communications will be hard-wired telephone service or cellular telephones as appropriate.

**D.28.2 Telephone Numbers**

The telephone numbers for all emergency services, including the telephone numbers for the USA SHM, are listed in Table D-6. These phone numbers will be posted in the vehicles and all site personnel (teams) will be aware of the location of the closest telephone or will have direct communications to someone with telephone service availability.

**D.28.3 On-Site Communications**

Communication between personnel in the SZ and personnel in the EZ will be maintained at all times. Personnel in the EZ should remain in constant communication with the Project Geophysicist/SUXOS and UXOSO. Any failure of communication requires an evaluation of whether personnel should leave the EZ. A repeated long horn blast (15 sec or longer) on the support vehicle is the emergency signal to indicate that all personnel should leave the EZ and proceed to the designated rally point.

**D.29 DAILY AND WEEKLY SITE INSPECTIONS**

Daily Safety and Health inspections will be conducted by the UXOSO and the results will be recorded in the Safety Log and on inspection forms. The results of the inspection will be reported to the Site Manager/Geophysicist and/or SUXOS on a weekly basis; the UXOSO will conduct a compliance audit of the site and complete the Weekly Inspection form. The daily Safety and Health inspections will include:

- Scope of operations;
- Personnel assignments;
- Safety precautions on OE expected to be encountered;
- Equipment to be used;

- Emergency procedures to include requests for support;
- Communication procedures.

**D.30 REGULATIONS AND REFERENCES**

The safety and health of on-site personnel and the local community will be ensured by following all applicable requirements and regulations listed in the following publications:

- OSHA General Industry Standards, 29 CFR 1910;
- OSHA Construction Standards, 29 CFR 1926;
- Applicable sections of EPA 40 CFR Parts 260 to 299;
- Applicable sections of DOT 49 CFR Parts 100 to 199;
- USA Safety and Health Program (SHP);
- 2003 Threshold Limit Values and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists;
- DOD 6055.9-STD, DOD ammunition and Explosives Safety Standards;
- DOD 4160.21-M, Defense Reutilization and Marketing Manual;
- AR 200-1, Environmental Protection and Enhancement;
- USACE EP 75-1-2, UXO Support During HTRW and Construction Activities;
- USACE EP 385-1-95a, Basic Safety Considerations for Ordnance and Explosives Operations;
- USACE EM 385-1-1, Safety and Health Requirements Manual;
- USACE EM 1110-1-4009, Ordnance and Explosives Response;
- USACE ER 385-1-92, Safety and Occupational Health Document Requirements for Hazardous, Toxic, and Radioactive Waste (HTRW) Activities;
- Waste Remedial Actions;
- AR 385-10, The Army Safety Program;
- AR 385-16, System Safety Engineering and management;
- AR 385-40, W/USACE Supplement 1, Accident Reporting and Records.

**D.31 INCLEMENT WEATHER**

In the event of inclement weather: high winds, electrical storms, tornado, extremely hot weather (>100 degrees F), or extremely cold weather (<0 degrees F), it may be necessary to cease operations and evacuate the site. The UXOSO will be responsible for contacting the U.S. Weather Service on a daily basis. If necessary, the weather service will be contacted on a more frequent basis.

**D.32 HAZARD ANALYSIS**

The following Hazard Analysis worksheets (Table D-8 through D-13) were used to identify hazards associated with operations at the former Waikoloa Maneuver Area project site and the safety methods that would be used to mitigate, eliminate, or control exposure to hazards.

**D.33 SPILL CONTROL AND PREVENTION**

All fueling and maintenance of site vehicles, and other equipment will be performed offsite at appropriate commercial or private facilities. During site activities vehicles will be inspected daily for signs of leaking fluids. If leaks are found, the vehicle must be removed from the site and repaired.

If a severe leak of fuel or other fluids such as motor oil or transmission fluid occurs in the field the following procedures will be implemented.

- Promptly berm the site with dirt so that the fuel or fluid does not spread along the ground surface.
- Apply oil-absorbing material such as sawdust or kitty litter to the spill.
- Report the spill to the USACE OE Safety Specialist, SUXOS, or UXOSO and follow instructions for spills cleanup. It is anticipated that this usually will involve digging up and drumming contaminated soil, and subsequently disposing of it in an approved manner.
- Gasoline will be transported only in DOT-approved gas cans. The cans will not be filled to more than three-quarters full to prevent overfilling at the commercial service station and to prevent spillage if they are opened in the field. Absorbent material and a ground barrier such as plastic will be used if oils or fuels are placed on the site.

Table D-8. USA Hazard Analysis Location Survey and Mapping

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 1 of 3 Pgs.
CUSTOMER: USACE		Analyzed By: Robert Crownover
ACTIVITY: LOCATION SURVEY AND MAPPING		Date: 7/30/2003
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
1. Locate Boundaries, Monuments, and other Survey Points.	<p>a Potential OE. b Unplanned Detonations</p> <p>Potential Hazards c through h apply to this step.</p>	<ul style="list-style-type: none"> <li>• Observe all OE safety precautions, and use safe work practices</li> <li>• Only UXO qualified personnel will escort non-UXO personnel.</li> <li>• Be alert. Mark, avoid, and report any OE items.</li> <li>• Only UXO qualified personnel will mark OE items if encountered.</li> <li>• Keep personnel to a minimum during operations.</li> <li>• Use and enforce the buddy system.</li> <li>• Wear the appropriate PPE for the task being performed.</li> </ul>
2. Mark Boundaries, Monuments, and other Survey Points.	<p>a Potential OE. b Unplanned Detonations</p> <p>Potential Hazards c through h apply to this step.</p>	<ul style="list-style-type: none"> <li>• Only UXO qualified personnel will mark OE items if encountered.</li> <li>• Be alert. Mark, avoid, and report any OE items encountered.</li> <li>• Check for sub-surface anomalies prior to placing flags, stakes, monuments, or pins into the soil.</li> <li>• Keep personnel to a minimum during operations.</li> <li>• Use and enforce the buddy system.</li> <li>• Maintain team separation distances as required.</li> <li>• Wear the appropriate PPE for the task being performed.</li> </ul>

Table D-8. USA Hazard Analysis Location Survey and Mapping (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 2 of 3 Pgs.
ACTIVITY: LOCATION SURVEY AND MAPPING		
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
	c. Unauthorized Personnel	<ul style="list-style-type: none"> <li>• Cease operations when unauthorized personnel enter the EZ.</li> </ul>
	d. Wildlife and Insects.	<ul style="list-style-type: none"> <li>• Avoid and do not handle wildlife IAW the SSHP briefing.</li> <li>• Use insect repellent as necessary.</li> </ul>
	e. Poison/Toxic Plants.	<ul style="list-style-type: none"> <li>• Avoid suspect plants IAW the SSHP briefing.</li> <li>• Use barrier creams/ointments as necessary.</li> <li>• Decontaminate person and equipment as necessary.</li> </ul>
	f. Sunburn/Windburn.	<ul style="list-style-type: none"> <li>• Use sunscreen/barrier cream as necessary.</li> <li>• Dress for the weather.</li> </ul>
	g. Slips, Trips, and Falls.	<ul style="list-style-type: none"> <li>• Be aware of footing and terrain, watch for slips, trips, and falls hazards.</li> <li>• Avoid obstacles when possible.</li> <li>• Wear approved and appropriate work boots.</li> </ul>
	h. Heat and Cold Stress.	<ul style="list-style-type: none"> <li>• Dress for the weather, in layers of removable clothing.</li> <li>• Drink the appropriate fluids on a frequent basis.</li> <li>• Know the signs and symptoms of Heat and Cold Stress.</li> <li>• Enforce buddy system monitoring.</li> </ul>

Table D-8. USA Hazard Analysis Location Survey and Mapping (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 3 of 3 Pgs.
ACTIVITY: LOCATION SURVEY AND MAPPING		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
	Inspections and checks will be conducted by the Tech III or other designated personnel.	Training will be conducted by the UXOSO or other designated personnel IAW the applicable sections of the WP/SSHP.
1. Vehicles	a Daily PMCS.	<ul style="list-style-type: none"> <li>Valid driver's license.</li> <li>Vehicle familiarity.</li> </ul>
2. Communications Equipment.	a Daily communications checks.	<ul style="list-style-type: none"> <li>As require by the WP and SSHP.</li> <li>Equipment familiarity.</li> <li>Knowledge of the Emergency Response and Notifications procedures IAW the SSHP.</li> </ul>
3. Fire Extinguishers	a Daily checks of extinguishers.	<ul style="list-style-type: none"> <li>Limitations and placement of extinguishers IAW the SSHP.</li> <li>Techniques for the use of extinguishers IAW the SSHP.</li> <li>Size and type of extinguisher required by task IAW the SSHP.</li> </ul>
4. First Aid Kits.	a Daily checks of Kits. b Weekly Inventory of Kits.	<ul style="list-style-type: none"> <li>First Aid and CPR training as required by the SSHP.</li> <li>Universal safety precautions for bloodborne pathogens IAW the SSHP.</li> </ul>
5. Survey Equipment and Magnetometers.	a Daily serviceability check. b Benchmark Check.	<ul style="list-style-type: none"> <li>Safe work practices and precautions associated with task being performed IAW the SSHP.</li> <li>Equipment inspection, maintenance, and adjustment IAW the WP/SSHP.</li> <li>Specific operator training IAW the WP/SSHP.</li> </ul>
6 Hand Tools/Marking Material	a. Proper type and quantity of material. b. Daily inspection of tools.	<ul style="list-style-type: none"> <li>Usage IAW the WP/SSHP.</li> <li>Inspection and maintenance of tools.</li> </ul>
	Other.	<ul style="list-style-type: none"> <li>Evacuation and emergency procedures IAW the SSHP.</li> <li>UXO identification and safety precautions for UXO and Non-UXO personnel IAW the WP/SSHP.</li> <li>OSHA qualifications and training as required IAW the WP/SSHP.</li> </ul>

Table D-9. USA Hazard Analysis Demolition

PROJECT NAME: Waikoloa Maneuver Area CUSTOMER: USACE ACTIVITY: OE DISPOSAL OPERATIONS		Activity Hazards Analysis Pg. 1 of 3 Pgs. Analyzed By: Robert Crownover Date:7/30/2003
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
1. Transportation of Explosives.	a Vehicle Accident. b Unplanned Detonations.  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>• Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>• Do not handle OE items unnecessarily.</li> <li>• Only UXO trained personnel will transport explosives.</li> <li>• Load and unload vehicles in designated areas only.</li> <li>• Block, brace, and secure cargo from movement during transportation.</li> <li>• Do not allow smoking or flame producing devices in the vicinity of explosives.</li> <li>• Observe compatibility and placarding requirements.</li> <li>• Do not fuel explosive laden vehicles.</li> <li>• Use only authorized explosive routes when transporting.</li> <li>• Obey all traffic laws, drive defensively.</li> <li>• Keep personnel to a minimum during operations.</li> <li>• Use and enforce the buddy system.</li> <li>• Wear the appropriate PPE for the task being performed.</li> </ul>
2. Preparing, Placing, and Detonating Explosives.	a Planned and Unplanned Detonations.  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>• Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>• Do not handle OE items unnecessarily.</li> <li>• Only UXO trained personnel will perform demolitions operations.</li> <li>• Do not allow smoking or flame producing devices in the vicinity of explosives.</li> <li>• Keep personnel to a minimum during operations.</li> <li>• Use and enforce the buddy system.</li> <li>• Wear the appropriate PPE for the task being performed.</li> <li>• Establish EZ and secure according to size and type of shot.</li> <li>• Stop all operations in un-authorized personnel enter the EZ.</li> <li>• Use engineering controls to reduce or eliminate fragmentation/overpressure hazards.</li> </ul>

Table D-9. USA Hazard Analysis Demolition (Continued)

PROJECT NAME: Waikoloa Maneuver Area ACTIVITY: OE DISPOSAL OPERATIONS		Activity Hazards Analysis Pg. 2 of 3 Pgs.
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
	c. Unauthorized Personnel	<ul style="list-style-type: none"> <li>• Cease operations when unauthorized personnel enter the EZ.</li> </ul>
	d. Wildlife and Insects.	<ul style="list-style-type: none"> <li>• Avoid and do not handle wildlife IAW the SSHP briefing.</li> <li>• Use insect repellent as necessary.</li> </ul>
	e. Poison/Toxic Plants.	<ul style="list-style-type: none"> <li>• Avoid suspect plants IAW the SSHP briefing.</li> <li>• Use barrier creams/ointments as necessary.</li> <li>• Decontaminate person and equipment as necessary.</li> </ul>
	f. Sunburn/Windburn.	<ul style="list-style-type: none"> <li>• Use sunscreen/barrier cream as necessary.</li> <li>• Dress for the weather.</li> </ul>
	g. Slips, Trips, and Falls.	<ul style="list-style-type: none"> <li>• Be aware of footing and terrain, watch for slips, trips, and falls hazards.</li> <li>• Avoid obstacles when possible.</li> <li>• Wear approved and appropriate work boots.</li> </ul>
	h. Heat and Cold Stress.	<ul style="list-style-type: none"> <li>• Dress for the weather, in layers of removable clothing.</li> <li>• Drink the appropriate fluids on a frequent basis.</li> <li>• Know the signs and symptoms of Heat and Cold Stress.</li> <li>• Enforce buddy system monitoring.</li> </ul>

Table D-9. USA Hazard Analysis Demolition (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 3 of 3 Pgs.	
ACTIVITY: OE DISPOSAL OPERATIONS			
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS	
	Inspections and checks will be conducted by the Tech III or other designated personnel.	Training will be conducted by the UXOSO or other designated personnel IAW the applicable sections of the WP/SSHP.	
1. Vehicles	a Daily PMCS.	<ul style="list-style-type: none"> <li>Valid driver's license.</li> <li>Vehicle familiarity.</li> </ul>	
2. Communications Equipment.	a. Daily communications checks.	<ul style="list-style-type: none"> <li>As require by the WP and SSHP.</li> <li>Equipment familiarity.</li> <li>Knowledge of the Emergency Response and Notifications procedures IAW the SSHP.</li> </ul>	
3. Fire Extinguishers	a Daily checks of extinguishers.	<ul style="list-style-type: none"> <li>Limitations and placement of extinguishers IAW the SSHP.</li> <li>Techniques for the use of extinguishers IAW the SSHP.</li> <li>Size and type of extinguisher required by task IAW the SSHP.</li> </ul>	
4. First Aid Kits.	a Daily checks of Kits. b Weekly Inventory of Kits.	<ul style="list-style-type: none"> <li>First Aid and CPR training as required by the SSHP.</li> <li>Universal safety precautions for bloodborne pathogens IAW the SSHP.</li> </ul>	
5. Demolition Material.	a Serviceability check. b Quantity requirements.	<ul style="list-style-type: none"> <li>Safe work practices and precautions associated with task being performed IAW the SSHP.</li> <li>Equipment inspection, maintenance, and usage IAW the WP/SSHP.</li> </ul>	
	Other.	<ul style="list-style-type: none"> <li>Evacuation and emergency procedures IAW the SSHP.</li> <li>UXO identification and safety precautions for UXO and Non-UXO personnel IAW the WP/SSHP.</li> <li>OSHA qualifications and training as required IAW the WP/SSHP.</li> </ul>	

Table D-10. USA Hazard Analysis Scrap Inspection

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 1 of 3 Pgs.
CUSTOMER: USACE		Analyzed By: Robert Crownover
ACTIVITY: OE/NON-OE SCRAP INSPECTION		Date: 7/30/2003
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
1. Initial Collection of Material.	<p>a Potential OE. b Unplanned Detonations</p> <p>Potential Hazards c through i apply to this step.</p>	<ul style="list-style-type: none"> <li>• Observe all OE safety precautions, and follow safe work practices.</li> <li>• Only UXO qualified personnel will inspect scrap material IAW the WP/SSHP.</li> <li>• Only UXO qualified personnel will handle OE items if encountered.</li> <li>• Handle material as few times as possible.</li> <li>• Place collection points away from personnel.</li> <li>• Maintain records of quantities and types of materials.</li> <li>• Keep personnel to a minimum during operations.</li> <li>• Use and enforce the buddy system.</li> <li>• Be Alert. Mark and report any OE encountered.</li> <li>• Wear the appropriate PPE for the task being performed.</li> </ul>
2. Consolidation and packaging material.	<p>a Potential OE. b Unplanned Detonations</p> <p>Potential Hazards c through i apply to this step.</p>	<ul style="list-style-type: none"> <li>• Observe all OE safety precautions, and follow safe work practices.</li> <li>• Keep personnel to a minimum during operations.</li> <li>• Wear the appropriate PPE for the task being performed.</li> <li>• Handle material/containers as few times as possible.</li> <li>• Secure containers against unauthorized use.</li> <li>• Be alert. Mark and report and OE items encountered.</li> <li>• Only UXO qualified personnel will inspect scrap materials.</li> <li>• Only authorized personnel (IAW the WP/SSHP) will sign DD Form 1348-1a.</li> </ul>

Table D-10. USA Hazard Analysis Scrap Inspection (Continued)

PROJECT NAME: Waikoloa Maneuver Area Activity Hazards Analysis Pg. 2 of 3 Pgs.		
ACTIVITY: OE/NON-OE SCRAP INSPECTION		
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
	c. Unauthorized Personnel	<ul style="list-style-type: none"> <li>• Cease operations when unauthorized personnel enter the EZ.</li> </ul>
	d. Wildlife and Insects.	<ul style="list-style-type: none"> <li>• Avoid and do not handle wildlife IAW the SSHP briefing.</li> <li>• Use insect repellent as necessary.</li> </ul>
	e. Poison/Toxic Plants.	<ul style="list-style-type: none"> <li>• Avoid suspect plants IAW the SSHP briefing.</li> <li>• Use barrier creams/ointments as necessary.</li> <li>• Decontaminate person and equipment as necessary.</li> </ul>
	f. Sunburn/Windburn.	<ul style="list-style-type: none"> <li>• Use sunscreen/barrier cream as necessary.</li> <li>• Dress for the weather.</li> </ul>
	g. Slips, Trips, and Falls.	<ul style="list-style-type: none"> <li>• Be aware of footing and terrain, watch for slips, trips, and falls hazards.</li> <li>• Avoid obstacles when possible.</li> <li>• Wear approved and appropriate work boots.</li> </ul>
	h. Heat and Cold Stress.	<ul style="list-style-type: none"> <li>• Dress for the weather, in layers of removable clothing.</li> <li>• Drink the appropriate fluids on a frequent basis.</li> <li>• Know the signs and symptoms of Heat and Cold Stress.</li> <li>• Enforce buddy system monitoring.</li> </ul>
	i. Cuts, Punctures, and Crushing Hazards.	<ul style="list-style-type: none"> <li>• Observe safe work practices, operating precautions, and instructions for the equipment in use.</li> <li>• Wear the proper PPE for the task being performed.</li> <li>• Use care when handling scrap material, watch for sharp edges and contaminated surfaces.</li> <li>• Do not insert extremities into, over, around, or under containers or equipment having pinch points, cutting, crushing, or burning hazards.</li> </ul>

Table D-10. USA Hazard Analysis Scrap Inspection (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 3 of 3 Pgs.
ACTIVITY: OE/NON-OE SCRAP INSPECTION		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
	Inspections and checks will be conducted by the Tech III or other designated personnel.	Training will be conducted by the UXOSO or other designated personnel IAW the applicable sections of the WP/SSHP.
1. Vehicles	a Daily PMCS.	<ul style="list-style-type: none"> <li>Valid driver's license.</li> <li>Vehicle familiarity.</li> </ul>
2. Communications Equipment.	a Daily communications checks.	<ul style="list-style-type: none"> <li>As require by the WP and SSHP.</li> <li>Equipment familiarity.</li> <li>Knowledge of the Emergency Response and Notifications procedures IAW the SSHP.</li> </ul>
3. Fire Extinguishers	a. Daily checks of extinguishers.	<ul style="list-style-type: none"> <li>Limitations and placement of extinguishers IAW the SSHP.</li> <li>Techniques for the use of extinguishers IAW the SSHP.</li> <li>Size and type of extinguisher required by task IAW the SSHP.</li> </ul>
4. First Aid Kits.	a Daily checks of Kits. b Weekly Inventory of Kits.	<ul style="list-style-type: none"> <li>First Aid and CPR training as required by the SSHP.</li> <li>Universal safety precautions for bloodborne pathogens IAW the SSHP.</li> </ul>
5. Material Containers and Handling Equipment.	a Serviceability Check.	<ul style="list-style-type: none"> <li>Safe work practices and precautions associated with task being performed IAW the SSHP.</li> <li>Equipment inspection, maintenance, and adjustment IAW the WP/SSHP.</li> <li>Specific operator training IAW the WP/SSHP.</li> </ul>
6.	Other	<ul style="list-style-type: none"> <li>Evacuation and emergency procedures IAW the SSHP.</li> <li>UXO safety precautions for UXO and non-UXO personnel IAW the WP/SSHP.</li> <li>OSHA qualifications and training as required IAW the WP/SSHP.</li> </ul>

Table D-11. USA Hazard Analysis Quality Control

PROJECT NAME: Waikoloa Maneuver Area CUSTOMER: USACE ACTIVITY: OE QUALITY CONTROL		Activity Hazards Analysis Pg. 1 of 3 Pgs. Analyzed By: Robert Crownover Date: 7/30/2003
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
1. Locate OE.	a Potential OE. b Unplanned Detonations  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>Do not handle OE items unnecessarily.</li> <li>Only UXO qualified personnel will perform UXOQC activities.</li> <li>Keep personnel to a minimum during operations.</li> <li>Use and enforce the buddy system.</li> <li>Maintain established Exclusion Zones based on the MPM.</li> <li>Maintain established and observe team separation distances.</li> <li>Wear the appropriate PPE for the task being performed.</li> </ul>
2. Excavate OE.	a Potential OE. b Unplanned Detonations  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>Do not handle OE items unnecessarily.</li> <li>Only UXO qualified personnel will excavate anomalies.</li> <li>Keep personnel to a minimum during operations.</li> <li>Use and enforce the buddy system.</li> <li>Do not dig directly over the anomaly.</li> <li>Hand excavate only when within 1 foot of the anomaly.</li> <li>Maintain team separation distances.</li> <li>Wear the appropriate PPE for the task being performed.</li> </ul>
3. Identify OE.	a Potential OE. b Unplanned Detonations  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>Do not handle OE items unnecessarily.</li> <li>Identification of OE items will be made by 2 UXO qualified personnel.</li> <li>Keep personnel to a minimum during operations.</li> <li>Use and enforce the buddy system.</li> <li>Maintain team separation distances.</li> <li>Wear the appropriate PPE for the task being performed.</li> </ul>

Table D-11. USA Hazard Analysis Quality Control (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 2 of 3 Pgs.
ACTIVITY: OE QUALITY CONTROL		
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
	c. Unauthorized Personnel	<ul style="list-style-type: none"> <li>• Cease operations when unauthorized personnel enter the EZ</li> </ul>
	d. Wildlife and Insects.	<ul style="list-style-type: none"> <li>• Avoid and do not handle wildlife IAW the SSHP briefing.</li> <li>• Use insect repellent as necessary.</li> </ul>
	e. Poison/Toxic Plants.	<ul style="list-style-type: none"> <li>• Avoid suspect plants IAW the SSHP briefing.</li> <li>• Use barrier creams/ointments as necessary.</li> <li>• Decontaminate person and equipment as necessary.</li> </ul>
	f. Sunburn/Windburn.	<ul style="list-style-type: none"> <li>• Use sunscreen/barrier cream as necessary.</li> <li>• Dress for the weather.</li> </ul>
	g. Slips, Trips, and Falls	<ul style="list-style-type: none"> <li>• Be aware of footing and terrain, watch for slips, trips, and falls hazards.</li> <li>• Avoid obstacles when possible.</li> <li>• Wear approved and appropriate work boots.</li> </ul>
	h. Heat and Cold Stress.	<ul style="list-style-type: none"> <li>• Dress for the weather, in layers of removable clothing.</li> <li>• Drink the appropriate fluids on a frequent basis.</li> <li>• Know the signs and symptoms of Heat and Cold Stress.</li> <li>• Enforce buddy system monitoring.</li> </ul>

Table D-11. USA Hazard Analysis Quality Control (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 3 of 3 Pgs.
ACTIVITY: OE QUALITY CONTROL		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
	Inspections and checks will be conducted by the Tech III or other designated personnel.	Training will be conducted by the UXOSO or other designated personnel IAW the applicable sections of the WP/SSHP.
1. Vehicles	a Daily PMCS.	<ul style="list-style-type: none"> <li>Valid driver's license.</li> <li>Vehicle familiarity.</li> </ul>
2. Communications Equipment.	a Daily communications checks.	<ul style="list-style-type: none"> <li>As require by the WP and SSHP.</li> <li>Equipment familiarity.</li> <li>Knowledge of the Emergency Response and Notifications procedures IAW the SSHP.</li> </ul>
3. Fire Extinguishers	a. Daily checks of extinguishers.	<ul style="list-style-type: none"> <li>Limitations and placement of extinguishers IAW the SSHP.</li> <li>Techniques for the use of extinguishers IAW the SSHP.</li> <li>Size and type of extinguisher required by task IAW the SSHP.</li> </ul>
3. First Aid Kits.	a Daily checks of Kits. b Weekly Inventory of Kits.	<ul style="list-style-type: none"> <li>First Aid and CPR training as required by the SSHP.</li> <li>Universal safety precautions for bloodborne pathogens IAW the SSHP.</li> </ul>
5. Magnetometers.	a Daily serviceability check.	<ul style="list-style-type: none"> <li>Safe work practices and precautions associated with task being performed IAW the SSHP.</li> <li>Equipment inspection, maintenance, and adjustment IAW the WP/SSHP.</li> <li>Specific operator training IAW the WP/SSHP.</li> </ul>
	Other.	<ul style="list-style-type: none"> <li>Evacuation and emergency procedures IAW the SSHP.</li> <li>UXO identification and safety precautions for UXO and Non-UXO personnel IAW the WP/SSHP.</li> <li>OSHA qualifications and training as required IAW the WP/SSHP.</li> </ul>

Table D-12. USA Hazard Analysis OE Investigation

PROJECT NAME: Waikoloa Maneuver Area CUSTOMER: USACE ACTIVITY: OE INVESTIGATION		Activity Hazards Analysis Pg. 1 of 3 Pgs. Analyzed By: Robert Crownover Date: 7/30/2003
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
1. Locate OE.	a. Potential OE. b. Unplanned Detonations  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>Do not handle OE items unnecessarily.</li> <li>Only UXO qualified personnel will escort non-UXO personnel.</li> <li>Only UXO trained personnel will locate anomalies.</li> <li>Keep personnel to a minimum during operations.</li> <li>Use and enforce the buddy system.</li> <li>Establish Exclusion Zones based on the MPM.</li> <li>Establish and observe team separation distances.</li> <li>Wear the appropriate PPE for the task being performed.</li> </ul>
2. Excavate OE.	a. Potential OE. b. Unplanned Detonations  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>Do not handle OE items unnecessarily.</li> <li>Only UXO qualified personnel will excavate anomalies.</li> <li>Keep personnel to a minimum during operations.</li> <li>Use and enforce the buddy system.</li> <li>Do not dig directly over the anomaly.</li> <li>Hand excavate only when within 1 foot of the anomaly.</li> <li>Maintain team separation distances.</li> <li>Wear the appropriate PPE for the task being performed.</li> </ul>
3. Identify OE.	a. Potential OE. b. Unplanned Detonations  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>Do not handle OE items unnecessarily.</li> <li>Identification of OE items will be made by 2 UXO qualified personnel.</li> <li>Keep personnel to a minimum during operations.</li> <li>Use and enforce the buddy system.</li> <li>Maintain team separation distances.</li> <li>Wear the appropriate PPE for the task being performed.</li> </ul>

Table D-12. USA Hazard Analysis OE Investigation (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 2 of 3 Pgs.
ACTIVITY: OE INVESTIGATION		
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
	c. Unauthorized Personnel	<ul style="list-style-type: none"> <li>• Cease operations when unauthorized personnel enter the EZ.</li> </ul>
	d. Wildlife and Insects.	<ul style="list-style-type: none"> <li>• Avoid and do not handle wildlife IAW the SSHP briefing.</li> <li>• Use insect repellent as necessary.</li> </ul>
	e. Poison/Toxic Plants.	<ul style="list-style-type: none"> <li>• Avoid suspect plants IAW the SSHP briefing.</li> <li>• Use barrier creams/ointments as necessary.</li> <li>• Decontaminate person and equipment as necessary.</li> </ul>
	f. Sunburn/Windburn.	<ul style="list-style-type: none"> <li>• Use sunscreen/barrier cream as necessary.</li> <li>• Dress for the weather.</li> </ul>
	g. Slips, Trips, and Falls.	<ul style="list-style-type: none"> <li>• Be aware of footing and terrain, watch for slips, trips, and falls hazards.</li> <li>• Avoid obstacles when possible.</li> <li>• Wear approved and appropriate work boots.</li> </ul>
	h. Heat and Cold Stress.	<ul style="list-style-type: none"> <li>• Dress for the weather, in layers of removable clothing.</li> <li>• Drink the appropriate fluids on a frequent basis.</li> <li>• Know the signs and symptoms of Heat and Cold Stress.</li> <li>• Enforce buddy system monitoring.</li> </ul>

Table D-12. USA Hazard Analysis OE Investigation (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 3 of 3 Pgs.
ACTIVITY: OE INVESTIGATION		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
	Inspections and checks will be conducted by the Tech III or other designated personnel.	Training will be conducted by the UXOSO or other designated personnel IAW the applicable sections of the WP/SSHP.
1. Vehicles	a. Daily PMCS.	<ul style="list-style-type: none"> <li>Valid driver's license.</li> <li>Vehicle familiarity.</li> </ul>
2. Communications Equipment.	a. Daily communications checks.	<ul style="list-style-type: none"> <li>As require by the WP and SSHP.</li> <li>Equipment familiarity.</li> <li>Knowledge of the Emergency Response and Notifications procedures IAW the SSHP.</li> </ul>
3. Fire Extinguishers	a. Daily checks of extinguishers.	<ul style="list-style-type: none"> <li>Limitations and placement of extinguishers IAW the SSHP.</li> <li>Techniques for the use of extinguishers IAW the SSHP.</li> <li>Size and type of extinguisher required by task IAW the SSHP.</li> </ul>
4. First Aid Kits.	a. Daily checks of Kits. b. Weekly Inventory of Kits.	<ul style="list-style-type: none"> <li>First Aid and CPR training as required by the SSHP.</li> <li>Universal safety precautions for bloodborne pathogens IAW the SSHP.</li> </ul>
5. Magnetometers.	a. Daily serviceability check.	<ul style="list-style-type: none"> <li>Safe work practices and precautions associated with task being performed IAW the SSHP.</li> <li>Equipment inspection, maintenance, and adjustment IAW the WP/SSHP.</li> <li>Specific operator training IAW the WP/SSHP.</li> </ul>
	Other.	<ul style="list-style-type: none"> <li>Evacuation and emergency procedures IAW the SSHP.</li> <li>UXO identification and safety precautions for UXO and Non-UXO personnel IAW the WP/SSHP.</li> <li>OSHA qualifications and training as required IAW the WP/SSHP.</li> </ul>

Table D-13. USA Hazard Analysis Digital Geophysical Mapping (Land)

PROJECT NAME: Waikoloa Maneuver Area CUSTOMER: USACE ACTIVITY: DGM SURVEY OPERATIONS (Land)		Activity Hazards Analysis Pg. 1 of 3 Pgs. Analyzed By: Robert Crownover Date: 7/30/2003
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
1. Acquire Data using DGM.	a. Potential OE. b. Unplanned Detonations  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>• Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>• Only UXO qualified personnel will escort non-UXO personnel.</li> <li>• Keep personnel to a minimum during operations.</li> <li>• Use and enforce the buddy system.</li> <li>• Establish Exclusion Zones based on the MPM.</li> <li>• Establish and observe team separation distances.</li> <li>• Wear the appropriate PPE for the task being performed.</li> </ul>
2. Re-Acquire Anomalies/Targets.	a. Potential OE. b. Unplanned Detonations  Potential Hazards c through h apply to this step.	<ul style="list-style-type: none"> <li>• Observe all OE safety precautions, such as movement, heat, shock, and friction.</li> <li>• Do not handle OE items if encountered.</li> <li>• Only trained personnel will mark anomalies.</li> <li>• Keep personnel to a minimum during operations.</li> <li>• Use and enforce the buddy system.</li> <li>• Maintain team separation distances.</li> <li>• Wear the appropriate PPE for the task being performed.</li> </ul>

Table D-13. USA Hazard Analysis Digital Geophysical Mapping (Land) (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 2 of 3 Pgs.
ACTIVITY: DGM SURVEY OPERATIONS (Land)		
PRINCIPLE STEPS	POTENTIAL HAZARDS	RECOMMENDED CONTROLS
	c. Unauthorized Personnel	<ul style="list-style-type: none"> <li>• Cease operations when unauthorized personnel enter the EZ.</li> </ul>
	d. Wildlife and Insects.	<ul style="list-style-type: none"> <li>• Avoid and do not handle wildlife IAW the SSHP briefing.</li> <li>• Use insect repellent as necessary.</li> </ul>
	e. Poison/Toxic Plants.	<ul style="list-style-type: none"> <li>• Avoid suspect plants IAW the SSHP briefing.</li> <li>• Use barrier creams/ointments as necessary.</li> <li>• Decontaminate person and equipment as necessary.</li> </ul>
	f. Sunburn/Windburn.	<ul style="list-style-type: none"> <li>• Use sunscreen/barrier cream as necessary.</li> <li>• Dress for the weather.</li> </ul>
	g. Slips, Trips, and Falls.	<ul style="list-style-type: none"> <li>• Be aware of footing and terrain, watch for slips, trips, and falls hazards.</li> <li>• Avoid obstacles when possible.</li> <li>• Wear approved and appropriate work boots.</li> </ul>
	h. Heat and Cold Stress.	<ul style="list-style-type: none"> <li>• Dress for the weather, in layers of removable clothing.</li> <li>• Drink the appropriate fluids on a frequent basis.</li> <li>• Enforce buddy system monitoring.</li> <li>• Know the signs and symptoms of Heat and Cold Stress.</li> </ul>

Table D-13. USA Hazard Analysis Digital Geophysical Mapping (Land) (Continued)

PROJECT NAME: Waikoloa Maneuver Area		Activity Hazards Analysis Pg. 3 of 3 Pgs.
ACTIVITY: DGM SURVEY OPERATIONS (Land)		
EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
	Inspections and checks will be conducted by the Tech III or other designated personnel.	Training will be conducted by the UXOSO or other designated personnel IAW the applicable sections of the WP/SSHP.
1. Vehicles	a. Daily PMCS.	<ul style="list-style-type: none"> <li>Valid driver's license.</li> <li>Vehicle familiarity.</li> </ul>
2. Communications Equipment.	a. Daily communications checks.	<ul style="list-style-type: none"> <li>As require by the WP and SSHP.</li> <li>Equipment familiarity.</li> <li>Knowledge of the Emergency Response and Notifications procedures IAW the SSHP.</li> </ul>
3. Fire Extinguishers	a. Daily checks of extinguishers.	<ul style="list-style-type: none"> <li>Limitations and placement of extinguishers IAW the SSHP.</li> <li>Techniques for the use of extinguishers IAW the SSHP.</li> <li>Size and type of extinguisher required by task IAW the SSHP.</li> </ul>
4. First Aid Kits.	a. Daily checks of Kits. b. Weekly Inventory of Kits.	<ul style="list-style-type: none"> <li>First Aid and CPR training as required by the SSHP.</li> <li>Universal safety precautions for bloodborne pathogens IAW the SSHP.</li> </ul>
5. Survey Equipment, DGM and Magnetometers.	a. Daily serviceability check. b. Benchmark Check.	<ul style="list-style-type: none"> <li>Safe work practices and precautions associated with task being performed IAW the SSHP.</li> <li>Equipment inspection, maintenance, and adjustment IAW the WP/SSHP.</li> <li>Specific operator training IAW the WP/SSHP.</li> </ul>
6. Hand Tools/Marking Material	a. Proper type and quantity of material. b. Daily inspection of tools.	<ul style="list-style-type: none"> <li>Usage IAW the WP/SSHP.</li> <li>Inspection and maintenance of tools.</li> </ul>
	Other.	<ul style="list-style-type: none"> <li>Evacuation and emergency procedures IAW the SSHP.</li> <li>UXO identification and safety precautions for UXO and Non-UXO personnel IAW the WP/SSHP.</li> <li>OSHA qualifications and training as required IAW the WP/SSHP.</li> </ul>

**D.34 ORDNANCE SAFETY**

USACE EP 385-1-95a, Basic Safety Considerations for Ordnance and Explosives Operations  
This document can be found in Attachment 1.



ATTACHMENT 1

BASIC SAFETY CONSIDERATIONS FOR ORDNANCE AND EXPLOSIVES OPERATIONS





**US Army Corps  
of Engineers®**

EP 385-1-95a  
29 June 2001

SAFETY

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**BASIC SAFETY CONCEPTS AND  
CONSIDERATIONS FOR ORDNANCE  
AND EXPLOSIVES OPERATIONS**

**ENGINEER PAMPHLET**

**"Approved for public release; distribution is unlimited."**



## AVAILABILITY

Electronic copies of this and other U.S. Army Corps of Engineers publications are available on the Internet at <http://www.usace.army.mil/inet/usace-docs/>. This site is the only repository for all official USACE engineer regulations, circulars, manuals, and other documents originating from HQUSACE. Publications are provided in portable document format (PDF).



DEPARTMENT OF THE ARMY  
U.S. Army Corps of Engineers  
Washington, DC 20314-1000

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CESO

Pamphlet  
No. 385-1-95a

29 June 2001

Safety  
BASIC SAFETY CONCEPTS AND  
CONSIDERATIONS FOR ORDNANCE  
AND EXPLOSIVES OPERATIONS

1. Purpose. This pamphlet establishes U.S. Army Corps of Engineers (USACE) operating procedures for dealing with ordnance and explosives (OE) items at Formerly Used Defense Sites (FUDS), Base Realignment and Closure, and Installation Restoration projects. There are no absolutely safe procedures for dealing with OE items, merely procedures considered to be least dangerous; therefore, it is essential that a planned and systematic approach to dealing with such items be established.

2. Applicability. This pamphlet applies to all Headquarters, U.S. Army Corps of Engineers elements and all USACE Commands having responsibility for performing OE response activities.

3. Distribution Statement. Approved for public release; distribution is unlimited.

4. References.

- a. 27 CFR 55, Commerce in Explosives.
- b. 29 CFR 1926, Subpart P, Excavations.
- c. DOD 6055.9-STD, DOD Ammunition and Explosives Safety Standards.
- d. AR 385-64, U.S. Army Explosives Safety Program.
- e. DA Pam 385-64, Ammunition and Explosives Safety Standards.
- f. TM 60A-1-1-31, Explosive Ordnance Disposal Procedures: General Information on EOD Disposal Procedures.
- g. TB 700-2, Department of Defense Ammunition and Explosives Hazard Classification Procedures.
- h. ER 5-1-11, Program and Project Management.

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- i. ER 1110-1-12, Quality Management.
- j. EP 1110-1-17, Establishing a Temporary Open Burn and Open Detonation Site for Conventional Ordnance and Explosives Projects.
- k. EP 1110-1-18, Ordnance and Explosives Response.
- l. EM 385-1-1, Safety and Health Requirements Manual.
- m. HNC-ED-CS-S-98-1, Methods for Predicting Primary Fragmentation Characteristics of Cased Explosives, January 1998. This document is available on the Internet at <http://www.hnd.usace.army.mil/>.
- n. HNC-ED-CS-S-98-2, Method for Calculating Ranges to No More Than One Hazardous Fragment per 600 Square Feet, January 1998. This document is available on the Internet at <http://www.hnd.usace.army.mil/>.
- o. Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites, U.S. Army Engineering and Support Center, Huntsville, August 1998. This document is available on the Internet at <http://www.hnd.usace.army.mil/>.
- p. AFM 91-201, Explosives Safety Standards.
- q. NAVSEA OP5, Ammunition and Explosives Ashore Safety Regulations for Handling, Storing, Production, Renovation, and Shipping.
- r. NFPA 780, Standard for the Installation of Lightning Protection Systems.

5. Explanation of Abbreviations and Terms. Abbreviations/acronyms and special terms used in this document are explained in the glossary.

6. Policy. The policy of USACE is to produce products and services that fully meet customers' expectations of quality, timeliness, and cost effectiveness, within the bounds of legal responsibility. An acceptable level of quality does not imply perfection; however, there should be no compromise of functional, health, or safety requirements. Adherence to the principles outlined in ER 5-1-11 and ER 1110-1-12 will contribute to achieving this goal. OE response procedures must be formulated to ensure harmony with the USACE Strategic Vision and should be executed in concert with activities presented in other USACE guidance.

7. Responsibilities. USACE and contractor personnel involved with OE response projects are responsible for safely executing response actions in accordance with (IAW) the approved Site Safety and Health Plan, approved Work Plan, and all applicable laws, regulations, and policies.

8. General Safety Concern sand Procedures.

a. As a general rule, all fuzed unexploded ordnance (UXO) will be detonated in the original position found. This is the safest method to effect final disposition of munitions.

b. OE operations will not be conducted until all applicable plans for the site in question are prepared and approved. These plans will be based upon the concept of limiting exposure to the minimum number of personnel, for the minimum amount of time, to the minimum amount of OE consistent with safe and efficient operations.

c. Only UXO-qualified personnel will perform OE procedures. As an exception, a UXO Technician I may assist in the performance of OE procedures when under the supervision of a UXO Technician III or a UXO-qualified individual of higher rank than UXO Technician III. Non-UXO-qualified personnel who have been determined to be essential for the operations being performed may be utilized to perform OE-related procedures when supervised by a UXO Technician III or a UXO-qualified individual of higher rank than UXO Technician III. All personnel engaged in field operations will be thoroughly trained and capable of recognizing the specific hazards of the procedures being performed. To ensure that these procedures are performed to standards, all field personnel will be under the direct supervision of a UXO Technician III or a UXO-qualified individual of higher rank than UXO Technician III.

d. Personnel who will be handling OE items will not wear outer or inner garments having static-electricity-generating characteristics. Materials made of 100-percent polyester, nylon, silk, and wool are highly static producing. Refer to DA Pam 385-64 for more information regarding nonstatic-producing clothing.

e. Prior to any action being performed on an ordnance item, all fuzing will be definitively identified. This identification will consist of fuze type by function and condition (armed or unarmed) and the physical state/condition of the fuze, i.e., burned, broken, parts exposed/ sheared, etc.

f. OE operations will be conducted only during daylight hours.

9. OE Safety Precautions.

a. Every effort will be made to identify a suspect OE item. Under no circumstances will any fuzed UXO be moved in an attempt to make a definitive identification. The OE item will be visually examined for markings and other external features such as shape, size, and external

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fittings. If an unknown OE item is encountered, the onsite USACE representative will be notified immediately. If there is no onsite USACE representative, the USACE district or the U.S. Army Engineering and Support Center, Huntsville (USAESCH) OE Safety Group will be notified as soon as possible. If research of documentation is required, it will be initiated by USAESCH. Following is additional guidance for the safe handling of OE items:

- (1) Projectiles containing base-detonating fuzes are to be considered armed if the round is fired.
  - (2) Arming wires and popout pins on unarmed fuzes should be secured prior to moving OE items.
  - (3) Do not depress plungers, turn vanes, or rotate spindles, levers, setting rings, or other external fittings on OE items. Such actions may arm or activate the items.
  - (4) Do not attempt to remove any fuze(s) from OE items. Do not dismantle or strip components from any OE items.
  - (5) UXO personnel are not authorized to render inert any OE items found onsite.
  - (6) OE items will not be taken from the site as souvenirs/training aids.
  - (7) Civil War ordnance will be treated in the same manner as any other OE items.
- b. Prior to entering areas/ranges contaminated with Improved Conventional Munitions (ICMs) or submunitions, a Department of the Army (DA) waiver must be obtained by the affected installation or for FUDS properties, the executing Corps district. If an ICM or submunition is found at a site not previously known to contain ICMs or submunitions, work will cease. The discovered item will be identified, then properly disposed of (including guarding the item if disposition is to be delayed). Work will resume only when an ICM waiver has been obtained. For guidance on the preparation of waiver requests, contact the OE Mandatory Center of Expertise.
- c. Any time suspect chemical warfare materiel is encountered during conventional OE site activities, all work will immediately cease. Project personnel will withdraw along cleared paths upwind from the discovery. A team consisting of a minimum of two personnel will secure the area to prevent unauthorized access. Personnel should position themselves as far upwind as possible while still maintaining security of the area.

(1) On FUDS properties, the UXO team will notify the local point of contact (POC) designated in the Work Plan. The local POC will facilitate explosive ordnance disposal (EOD) response, and two personnel will secure the site until the EOD unit's arrival. If the local POC

designated in the Work Plan is not the local law enforcement agency, the local POC will inform the local law enforcement agency of the discovery if necessary. The EOD unit will notify the Technical Escort Unit (TEU) and secure the area until TEU's arrival. After notifying the local law enforcement agency (when necessary), the local POC will notify the USAESCH OE Safety Group of the actions taken.

(2) On active installations, the UXO team will normally notify the Range Control Officer, the Facility Engineer, post headquarters, or the POC designated in the Work Plan.

d. Avoid inhalation of and skin contact with smoke, fumes, and vapors of explosives and related hazardous materials.

e. Consider OE items which may have been exposed to fire and detonation as extremely hazardous. Chemical and physical changes may have occurred to an item's contents, which may have rendered the item more sensitive than in its original state.

f. Do not rely on the color coding of OE items for definitive identification. Munitions having incomplete or improper color codes have been encountered.

g. Avoid approaching the forward area of an OE item until it can be determined whether or not the item contains a shaped charge. The explosive jet, which is formed during detonation, can be lethal at great distances. Assume that all shaped-charge munitions contain a piezoelectric (PZ) fuzing system until investigation proves otherwise. PZ fuzing is extremely sensitive. It can function at the slightest physical change and can remain hazardous for an indefinite period of time.

h. Approach an unfired rocket motor from the rear at a 45-degree angle. Accidental ignition can cause a missile hazard and hot exhaust.

i. Do not expose unfired rocket motors to any electromagnetic radiation (EMR) sources. See DA Pam 385-64 for safe separation distances from various sources of EMR.

j. Consider an emplaced landmine to be armed until proven otherwise. It may be intentionally boobytrapped to deceive.

(1) Many training mines contain spotting charges capable of inflicting serious injury.

(2) Exercise extreme care with wooden mines that have been buried for long periods of time. Certain soil conditions can cause the wood to deteriorate, and any inadvertent movement or pressure can initiate the fuze.

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k. Assume that a practice OE item contains a live charge until investigation proves otherwise. Expended pyrotechnic and practice devices can contain red or white phosphorus (WP) residue. Due to incomplete combustion, this residue may re-ignite spontaneously if the crust is broken and exposed to air.

l. Do not approach a smoking WP munition. Burning WP may detonate the explosive burster charge at any time.

m. Foreign ordnance was shipped to the United States for exploitation and subsequent disposal. Every effort will be made to research all applicable documentation prior to commencement of a project involving foreign ordnance.

10. OE Storage. During OE projects, explosives storage falls into two categories, on Department of Defense (DOD) installations and off DOD installations.

a. On DOD installations, DOD 6055.9-STD and Service requirements (Army – AR 385-64; Navy – NAVSEA OP5; Air Force – AFM 91-201) will be met. For the remainder of this pamphlet, reference to DOD standards (i.e., DOD 6055.9-STD) also implies that Service explosives safety publications will be adhered to. Generally, the installation will have an existing explosives storage facility that meets DOD standards. If not, the contractor will establish a temporary storage facility. The compatibility of explosives defined in chapter 3, DOD 6055.9-STD, will be followed. Recovered OE items awaiting final disposition will not be stored with serviceable explosives. Commercial explosives will be assigned a DOD hazard classification (i.e., 1.1, 1.2, etc.) and storage compatibility grouping by the U.S. Army Technical Center for Explosives Safety prior to being stored on a military installation.

b. Off DOD installations, the contractor will be responsible for establishing a temporary explosives storage facility. This temporary storage facility will meet local, state, 27 CFR 55, AR 385-64, and DOD 6055.9-STD requirements to the greatest extent practicable.

(1) In cases where the facility cannot meet the intermagazine, inhabited building, and public traffic route quantity-distance requirements specified in DA Pam 385-64 and DOD 6055.9-STD, a barricading plan or other engineering controls to protect the public from accidental detonation must be submitted to and approved by the USAESCH Directorate of Engineering.

(2) Magazines must meet the requirements of 27 CFR 55, and each magazine must have a Net Explosive Weight and hazard classification established for the explosives to be stored.

(3) Each magazine must be provided lightning protection IAW DA Pam 385-64. The provisions of NFPA 780, which are consistent with Army guidance, may be used to supplement Army guidance where necessary.

(4) A physical security survey will be conducted to determine if fencing or guards are required. This survey will be coordinated through local law enforcement agencies. Generally, a fence around the magazine is not needed, IAW 27 CFR 55. However, the contractor is responsible for providing the degree of protection needed to prevent the theft of OE items.

c. A fire plan for either an on- or off-installation explosives storage facility will be prepared and coordinated with the local fire department. Placarding of magazines will be IAW local rules and regulations.

11. OE Transportation, Offsite. In the event that OE items must be transported offsite, the provisions of chapter 15, EP 1110-1-18, will be followed. In addition, USACE contractors are prohibited from transporting UXO offsite for destruction until the provisions of paragraph 1-9, TB 700-2, have been met.

12. OE Transportation, Onsite. The following safety procedures will be followed for the transportation of OE items onsite:

- a. Do not transport WP munitions unless they are immersed in water, mud, or wet sand.
- b. If loose pyrotechnic, tracer, flare, or similar mixtures are to be transported, they will be placed in No. 10 mineral oil or equivalent to minimize the fire and explosion hazards.
- c. Incendiary-loaded munitions should be placed on a bed of sand and covered with sand to help control the burn if a fire should start.
- d. If an unfired rocket motor must be transported, it will be positioned in the vehicle parallel to the rear axle. This will afford maximum protection for the personnel operating the vehicle.
- e. If a base-ejection projectile must be transported to a disposal facility, the base will be oriented in the vehicle such that it is parallel to the rear axle. This will afford maximum protection for the personnel operating the vehicle.
- f. OE items with exposed hazardous fillers, such as High Explosive, will be placed in appropriate containers with packing material to prevent migration of the hazardous fillers. Padding should be added to protect the exposed filler from heat, shock, and friction.

13. Exclusion Zone Operations. On OE project sites, it is the responsibility of the contractor's Unexploded Ordnance Safety Officer (UXOSO) to establish the exclusion zone for each UXO work area.

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a. The purpose of the exclusion zone is to protect nonessential personnel from blast overpressure and fragmentation hazards. Calculating exclusion zones with respect to intentional and unintentional detonations is discussed below.

(1) Intentional Detonations. The minimum separation distances specified in DOD 6055.9-STD, chapter 5, paragraph C5.5.4, will be used unless lesser distances have been calculated using HNC-ED-CS-S-98-1.

(2) Unintentional Detonations. If the identity of OE items on a site is unknown, the minimum separation distance specified in DOD 6055.9-STD, chapter 5, paragraph C5.5.4, will be used to establish the exclusion zones. When the identity of OE items is known, the USAESCH Directorate of Engineering will use HNC-ED-CS-S-98-1 and HNC-ED-CS-S-98-2 to determine the criteria for establishing the exclusion zones.

b. When multiple teams are working onsite, a team separation distance (TSD) will be established. The minimum TSD will be the greater of 200 feet or the K50 (0.9 pounds per square inch) overpressure distance.

c. While OE procedures are being conducted, only personnel essential for the operation will be allowed in the exclusion zone. When nonessential personnel enter the exclusion zone, all OE operations will cease. In addition to this work stoppage, the following actions will be taken:

(1) The individual(s) must receive a safety briefing and sign the visitors log prior to entering the zone.

(2) The individual(s) will be escorted by a UXO-qualified individual.

d. All personnel working within the exclusion zone will comply with the following:

(1) There will be no smoking within the exclusion zone, except in areas designated by the UXOSO.

(2) There will be no open fires for heating or cooking (gas stoves, grills, etc.) within the exclusion zone, except where authorized by the UXOSO.

(3) During geophysical detection operations, personnel will not wear any metal that would interfere with instrument operations.

14. OE Excavation Operations.

a. Hand excavation is the most reliable method for uncovering an OE item. However, hand excavation exposes personnel to the hazard of detonation . Therefore, only UXO-qualified personnel will be used to perform this task.

b. Earth-moving machinery (EMM) may be used to excavate overburden from suspected OE items. EMM will not be used to excavate within 12 inches of a suspected OE item. Once the EMM is within 12 inches of the suspected OE item, the excavation will be completed by hand excavation methods. Personnel who are not UXO qualified may operate EMM only when supervised by a UXO Technician III or a UXO-qualified individual of higher rank than a UXO Technician III.

(1) If more than one earth-moving machine is to be used onsite, the same minimum separation distances required for multiple work teams apply.

(2) EMM operations will be conducted within the guidelines of EM 385-1-1 and 29 CFR 1926, subpart P.

c. Excavation operations, whether by hand or EMM, will employ a stepdown or offset access method. Under no circumstances will any excavation be made directly over suspected OE items.

15. OE Disposal Operations. All disposal operations will be conducted IAW TM 60A-1-1-31, EP 1110-1-17, and the unnumbered USAESCH publication entitled Procedures for Demolition of Multiple Rounds (Consolidated Shots) on Ordnance and Explosives (OE) Sites.

a. As a general rule, all disposal operations will be accomplished by electrical means to ensure maximum safety. There are exceptions to this requirement in situations where static electricity or EMR hazards are present. Unintentional detonations can occur because of these induced currents (or lightning). The following precautions from DA Pam 385-64 are to be followed:

(1) Premature detonation of electric blasting caps by induced current from radio frequency signals is possible. Refer to DA Pam 385-64 for minimum safe distance with respect to transmitter power and indication of distance beyond which it is safe to conduct electric blasting even under the most adverse conditions.

(2) Lightning is a hazard with respect to both electric and nonelectric blasting caps. A direct hit or a nearby miss is almost certain to initiate either type of cap or other sensitive explosive elements such as caps in delay detonators. Lightning strikes, even at distant locations, may cause extremely high local earth currents that may initiate electrical firing circuits. Effects

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of remote lightning strikes are multiplied by their proximity to conducting elements such as those found in buildings, fences, railroads, bridges, streams, and underground cables or conduits. The only safe procedure is to suspend all blasting activities when an electrical storm approaches to within 10 miles of the site.

(3) Electric power lines also pose a hazard with respect to electric initiating systems. It is recommended that any disposal operation closer than 155 meters to electric power lines be done with a nonelectric system.

b. The only acceptable disposal method is the one stated in the appropriate TM 60 Series manual for specific ordnance types. Any commercial explosives being used will be equivalent to the military explosive required for the disposal operation.

c. If justified by the situation, protective measures to reduce shock, blast over-pressure, and fragmentation will be taken. The USAESCH Directorate of Engineering will assist in any design work and will review for approval all proposed protective measures.

d. Minimum separations distances for personnel during OE disposal will be IAW DOD 6055.9-STD, chapter 5.

e. During open detonation operations, lifting lugs, strong backs, base plates, etc., will be oriented away from personnel locations.

f. Once disposal operations are completed, a thorough search of the immediate area will be conducted, with a magnetometer to ensure that a complete disposal was accomplished.

g. Inert ordnance will not be disposed of as scrap until the internal tillers/voids have been exposed and unconfined.

FOR THE COMMANDER:



ROBERT L. DAVIS  
Colonel, Corps of Engineers  
Chief of Staff

## GLOSSARY

### Section I Abbreviations

AFM.....	Air Force Manual
AR.....	Army Regulation
CFR.....	Code of Federal Regulations
DA.....	Department of the Army
DA Pam.....	Department of the Army Pamphlet
DOD.....	Department of Defense
EMM.....	Earth-Moving Machinery
EMR.....	Electromagnetic Radiation
EOD.....	Explosive Ordnance Disposal
FUDS.....	Formerly Used Defense Sites
IAW.....	In Accordance With
ICM.....	Improved Conventional Munition
NAVSEA OP.....	Naval Sea Systems Command Ordnance Pamphlet
NFPA.....	National Fire Protection Association
OE.....	Ordnance and Explosives
POC.....	Point of Contact
PZ.....	Piezoelectric
STD.....	Standard
TB.....	Technical Bulletin

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TEU..... Technical Escort Unit  
TSD..... Team Separation Distance  
USACE..... U.S. Army Corps of Engineers  
USAESCH..... U.S. Army Engineering and Support Center, Huntsville  
UXO..... Unexploded Ordnance  
UXOSO..... Unexploded Ordnance Safety Officer  
WP..... White Phosphorus

## Section II Terms

### OE Procedures

Procedures which include, but are not limited to, the following actions performed by a UXO-qualified individual:

- a. Gaining access to (manual excavation) and identifying subsurface anomalies and assessing the condition of buried OE.
- b. Identifying and assessing the condition of surface OE.
- c. Recovering and making final disposal of all OE.

### OE-Related Procedures

Procedures which include, but are not limited to, the following actions which may be performed by a non-UXO-qualified individual:

- a. Locating and marking subsurface anomalies.
- b. Locating and marking suspected surface OE.
- c. Transporting and storing recovered OE.
- d. Utilizing EMM to excavate overburden from suspected OE.

**Ordnance and Explosives (OE)**

Consists of (1) military munitions that have been abandoned, expelled from demolition pits or burning pads, lost, discarded, or buried, (2) UXO, (3) soil presenting explosion hazards, and (4) buildings with explosives residues that present explosion hazards.

**Unexploded Ordnance (UXO)**

Military munitions that have been primed, fuzed, armed, or otherwise prepared for action and have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material and remain unexploded either by malfunction, design, or any other cause.

**UXO-Qualified Personnel**

Personnel meeting the requirements for the positions of UXO Technician II, UXO Technician III, UXO Safety Officer, UXO Quality Control Specialist, and Senior UXO Supervisor. For qualification requirements, refer to EP 1110-1-18.



ATTACHMENT 2

SITE SAFETY AND HEALTH PLAN ACCEPTANCE







**ATTACHMENT 3**

**SAFETY BRIEFING CHECKLIST**



**SAFETY BRIEFING CHECKLIST**

SITE NAME: Former Waikoloa Maneuver Area

DATE/TIME: \_\_\_\_\_

GENERAL INFORMATION

\_\_\_\_\_ Purpose of Visit

\_\_\_\_\_ Key Site Personnel/Responsibilities

\_\_\_\_\_ Training & Medical Requirements

Site-Specific Information

\_\_\_\_\_ Project Description/Characterization/Past Uses

\_\_\_\_\_ Previous Studies/History

\_\_\_\_\_ Contaminant Characterization

\_\_\_\_\_ Potential Site Hazards/Health Effects

\_\_\_\_\_ OE Safety Procedures

\_\_\_\_\_ Project Personal Protective Equipment (PPE) Program

\_\_\_\_\_ Project SOPs

\_\_\_\_\_ Project Control Measures, Decontamination and Communications

\_\_\_\_\_ Emergency Equipment

\_\_\_\_\_ Emergency Response/Phone Numbers/Nearest Medical Facility

\_\_\_\_\_ Unanticipated hazardous conditions shall result in ceasing activities and evacuation of the site in accordance with instructions from the UXOSO.



ATTACHMENT 4

MATERIAL SAFETY DATA SHEETS





# MATERIAL SAFETY DATA SHEET

Austin Star Detonator Company  
901 Cantu Road  
Brownsville, TX 78520

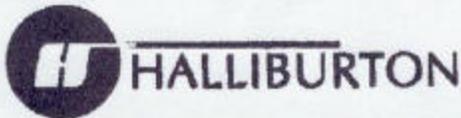
## SHOCK★STAR™ SHOCK TUBING

DATE SEPTEMBER 2001

MSDS NO. C-3

PAGE 1 OF 2

SECTION I		Issued by the Safety and Compliance Dept.	
For Technical Assistance and Emergencies Contact: AUSTIN POWDER COMPANY 25800 SCIENCE PARK DRIVE CLEVELAND, OHIO 44122 DAY 216-464-2400 NIGHT 216-464-2407		TRADE NAME AND SYNONYMS Signal Transmission Tubing Shock Tube LEAD-IN-LINE (L-I-L)	
SECTION II HAZARDOUS INGREDIENTS			
The explosive components of this device (HMX and Aluminum Powder) are less than 0.4 percent by weight of the shock tube and are totally enclosed in the tubing.			
SECTION III PHYSICAL DATA			
BOILING POINT	N/A	VAPOR PRESSURE (mm Hg)	N/A
SPECIFIC GRAVITY (H <sub>2</sub> O = 1)	N/A	VAPOR DENSITY (Air = 1)	N/A
PERCENT VOLATILE BY VOL. (%)	None	EVAPORATION RATE:	N/A
SOLUBILITY IN WATER:	Negligible		
APPEARANCE AND ODOR: Flexible ionomer resin plastic tubing with a minute amount of an extremely fine, silver colored explosive composition on the interior walls of the tube. No odor.			
SECTION IV FIRE AND EXPLOSION DATA			
FLASH POINT:		N/A	
FLAMMABLE LIMITS:		N/A	
EXTINGUISHING MEDIA:		Water, CO <sub>2</sub> , foam, dry chemical fire extinguisher.	
SPECIAL FIREFIGHTING PROCEDURES:		Not determined.	
UNUSUAL FIRE AND EXPLOSION HAZARDS:		Avoid toxic fumes from fire.	
SECTION V HEALTH HAZARD DATA			
THRESHOLD LIMIT VALUE:		Not determined.	
EFFECTS OF OVEREXPOSURE:		Not determined.	
EMERGENCY AND FIRST AID PROCEDURES:			
FUMES:		Remove to fresh air.	



MATERIAL SAFETY DATA SHEET

PRODUCT IDENTIFICATION

PRODUCT NAME: SHAPED CHARGE PRODUCTS Revision Date: 9/29/94
TRADE NAMES AND SYNONYMS
Tubing Cutters, Drill Pipe Cutters, Casing Cutters,
Big Hole Charges, Deep Penetrating Charges, Gravel
Pack Charges, DYNA-Strip Charges, DYNA-Cap Charges,
DYNA-Jet Charges, SSB Charges, Sidewinder Charges,
GSC Charges, Junk shot Charges, Linear Shaped Charges, (LSC)
Flexible Linear Shaped Charges (FLSC)

MANUFACTURER: Halliburton Energy Services
Explosive Products Center
8432 South I-35 W
Alvarado, Texas 76009-9775

PRODUCT INFORMATION PHONE: (817) 783-5111
EMERGENCY PHONE: (817) 783-5111
TRANSPORTATION EMERGENCY PHONE: INFOTRAC: (800) 535-5053 U.S. & CANADA

HAZARDOUS COMPONENTS

Table with columns: CHEMICAL, Exposure Limits (TLV, PEL). Rows include Cyclotrimethylenetrinitramine (RDX), Cyclotetramethylenetetranitramine (HMX), Hexanitrostilbene (HNS), 2,6-bis (Picrylamino)-3,5-dinitropyridine (PYX), Nonanitroterphenyl (NONA), Desensitizing Wax, Iron, Copper, Tin, Aluminum, Corrosion Resistant Steel, Lead, Antimony.

PHYSICAL DATA

Packed powder charges (encased in metal casing).

HAZARDOUS REACTIVITY

INSTABILITY: May detonate with friction, impact, heat, and low level electrical current.
INCOMPATIBILITY: Acids and alkalis.
HAZARD DECOMPOSITION: Detonation may product shrapnel. Gases produced may contain carbon monoxide and nitrogen oxide. Lead fumes may also be produced.
POLYMERISATION: Polymerization will not occur.

FIRE AND EXPLOSION DATA

FLASHPOINT: N/A

EXTINGUISHING MEDIA: None

SPECIAL FIRE FIGHTING PROCEDURES: DO NOT fight fire. Isolate area. Evacuate personnel to a safe area. Guard against intruders. Allow fire to burn itself out.

**SPECIAL FIRE FIGHTING PROCEDURES:** DO NOT fight fire. Isolate area. Evacuate personnel to a safe area. Guard against intruders. Allow fire to burn itself out.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** May detonate with impact or on heating. May explode and throw fragments 1 mile or more if fire reaches cargo. Evacuate all persons, including emergency responders from the area.

\*\*\*\*\*

**HEALTH HAZARDS**

Shaped Charge Products do not present health hazards in normal handling and use. However, the products are Class A or Class C Explosives and detonation may cause severe physical injury, including death. All explosives are dangerous and must be handled carefully and used following approved safety procedures under the direction of competent, experienced persons in accordance with all applicable Federal, State, and Local Laws, Regulations and Ordinances.

Inhalation of explosive powders may cause nervous system irregularities including headaches and dizziness. May be absorbed through the skin in toxic amounts.

Over exposure to lead may cause adverse effects to the blood forming, nervous, urinary, and reproductive systems including weakness, weight loss, insomnia, constipation, anemia, motor weakness, and encephalopathy. Lead may penetrate the placental barrier and has caused congenital abnormalities in animals. Several animal studies have indicated that high doses of lead may be carcinogenic.

Nitrogen oxides generated during use are skin, eye and respiratory tract irritants.

**CARCINOGENICITY**

None of the components of these materials are listed as a carcinogen by NTP, IARC, or OSHA.

**OTHER SYMPTOMS AFFECTED**

A review of available data does not identify any conditions worsened by exposure to this product.

**FIRST AID**

**INHALATION:**

Not a likely route of exposure. If inhaled, remove to fresh air. If not breathing, give artificial respiration, preferably by mouth-to-mouth. If breathing is difficult, give oxygen. Seek Prompt Medical Attention.

**EYE AND SKIN CONTACT:**

Not a likely route of exposure.

**INGESTION:**

Not a likely route of exposure.

**NOTE:** Seek prompt medical attention if detonation caused physical injury.

\*\*\*\*\*

**SPILL OR LEAK PROCEDURES:**

Use appropriate protective equipment. Isolate area and remove sources of friction, impact, heat, low level electrical current, electrostatic or RF energy. Only competent, experienced persons should be involved in clean up procedures. Sweep up with non-sparking tools and remove.

**WASTE DISPOSAL**

Disposal of in compliance with applicable Federal Regulations under the authority of the Resource Conservation and Recovery Act (40 CFR, parts 260-271).

\*\*\*\*\*

**SPECIAL PROTECTION INFORMATION**

**VENTILATION:** Use only with adequate ventilation.

**RESPIRATORY:** NIOSH/MESA approved particle masks for dust and mist.

**EYE:** Safety glasses or goggles.

**GLOVES:** Normal work gloves.

\*\*\*\*\*

**SPECIAL PRECAUTIONS**

Keep away from friction, impact and heat. Do Not consume food, drink or tobacco in areas where they may become contaminated with these materials.

**STORAGE CONDITIONS**

Refer to manufacturer's recommendations and warning for proper storage conditions.

\*\*\*\*\*

THE INFORMATION WHICH IS CONTAINED IN THIS DOCUMENT IS BASED UPON AVAILABLE DATA AND BELIEVED TO BE CORRECT. HOWEVER, AS SUCH HAS BEEN OBTAINED FROM VARIOUS SOURCES, INCLUDING THE MANUFACTURER AND INDEPENDENT LABORATORIES, IT IS GIVEN WITHOUT WARRANTY OR REPRESENTATION THAT IT IS COMPLETE, ACCURATE AND CAN BE RELIED UPON. HALLIBURTON ENERGY SERVICES HAS NOT ATTEMPTED TO CONCEAL IN ANY WAY THE DELETERIOUS ASPECTS OF THE PRODUCT LISTED HEREIN, BUT MAKES NO WARRANTY AS TO SUCH. FURTHER, AS HALLIBURTON ENERGY SERVICES CANNOT ANTICIPATE NOR CONTROL THE MANY SITUATIONS IN WHICH THE LISTED PRODUCT OR THIS INFORMATION MAY BE USED BY OUR CUSTOMER, THERE IS NO GUARANTEE THAT THE HEALTH AND SAFETY PRECAUTIONS SUGGESTED WILL BE PROPER UNDER ALL CONDITIONS. IT IS THE SOLE RESPONSIBILITY OF EACH USER OF THE LISTED PRODUCT TO DETERMINE AND COMPLY WITH THE REQUIREMENTS OF ALL APPLICABLE LAWS AND REGULATIONS REGARDING ITS USE. THIS INFORMATION IS GIVEN SOLELY FOR THE PURPOSES OF SAFETY TO PERSONS AND PROPERTY. ANY OTHER USE OF THIS INFORMATION IS EXPRESSLY PROHIBITED. GOVERNMENT REGULATIONS DEPARTMENT, HALLIBURTON SERVICES.



**MSDS**  
**OIL, 2 CYCLE**

\*\*\* IDENTIFICATION \*\*\*

MSDS RECORD NUMBER : 800742  
 PRODUCT NAME(S): AMOCO 2 CYCLE ENG OIL  
 PRODUCT IDENTIFICATION: PRODUCT CODE R00000373007  
 DATE OF MSDS : 1993-06-02

\*\*\* MATERIAL SAFETY DATA \*\*\*

PRIMARY APPLICATION- ENGINE OIL  
 SYNONYMS..... : TWO-CYCLE ENGINE OIL  
 CAS REGISTRY NO: SEE SEC. 2  
 CAS NAME..... : NO CLASSIFICATION - MIXTURE  
 CHEMICAL FAMILY: BLEND  
 EMERGENCY PHONE NUMBERS (AFTER NORMAL BUSINESS HOURS)  
 SUN CO.. 1-800-964-8861  
 CHEMTREC. 1-800-424-9300

2. COMPOSITION / INFORMATION ON INGREDIENTS

EXPOSURE GUIDELINES

	OSHA	ACGIH
SUN/MFR		
COMPONENT/CAS NO.	LO%	HI%
STEL TWA	STEL TWA	STEL UNIT
LIMITS FOR THE PRODUCT:		
	5	5
MG/M3		

SEVERELY SOLVENT REFINED HEAVY PARAFFINIC PETROLEUM OIL

64741-88-4	65.00	90.00	5	5
MG/M3				

PROPRIETARY

10.00	30.00	NO
-------	-------	----

SPECIFIC LIMIT

ADDITIONAL EXPOSURE LIMITS

----- GOVERNMENT REGULATION  
 OTHER LIMIT- OIL MIST: 5 MG/M3 (OSHA PEL/ACGIH TLV)

3. HAZARDS IDENTIFICATION

FLASH POINT: 345 TYPICAL COC (DEG. F);  
 174 TYPICAL COC (DEG. C)  
 AUTOIGNITION TEMP.: NOT DETERMINED (DEG. F); NOT DETERMINED (DEG. C)

---FLAMMABLE LIMITS IN AIR---

EMERGENCY OVERVIEW -----  
 NOT EXPECTED TO CAUSE A SEVERE EMERGENCY HAZARD.  
 APPEARANCE-- GREEN COLORED OIL  
 ODOR-- SLIGHT ODOR  
 POTENTIAL HEALTH EFFECTS -----  
 PRIMARY ROUTES OF ENTRY- INHALATION( ) SKIN( X ) EYE( ) INGESTION( )  
 INHALATION -----  
 NO EFFECTS EXPECTED.  
 SKIN -----  
 PRACTICALLY NON-TOXIC IF ABSORBED (LD50 GREATER THAN 2000 MG/KG). MAY CAUSE MILD IRRITATION WITH PROLONGED OR REPEATED CONTACT.  
 EYE -----  
 CONTACT WITH THE EYE MAY CAUSE MINIMAL IRRITATION.  
 INGESTION -----  
 PRACTICALLY NON-TOXIC (LD50 > 15G/KG). CARCINOGEN LISTED BY-IARC(NO) NTP(NO) OSHA(NO) ACGIH(NO) OTHER(NO)  
 PRE-EXISTING MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE- SKIN DISORDERS  
 4. FIRST AID MEASURES  
 INHALATION -----  
 MOVE PERSON TO FRESH AIR.  
 SKIN -----  
 WASH WITH SOAP AND WATER UNTIL NO ODOR REMAINS. WASH CLOTHING BEFORE REUSE.  
 EYE -----  
 FLUSH WITH WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, OBTAIN MEDICAL ASSISTANCE.  
 INGESTION -----  
 PRACTICALLY NON-TOXIC -- INDUCTION OF VOMITING NOT REQUIRED. OBTAIN EMERGENCY MEDICAL ATTENTION. SMALL AMOUNTS WHICH ACCIDENTALLY ENTER MOUTH SHOULD BE RINSED OUT UNTIL TASTE OF IT IS GONE.  
 5. FIRE FIGHTING MEASURES  
 LOWER EXPLOSIVE LIMIT (LEL): NOT DETERMINED % VOLUME  
 UPPER EXPLOSIVE LIMIT (UEL): NOT DETERMINED % VOLUME  
 FIRE AND EXPLOSION HAZARDS



# MSDS

## OIL, 2 CYCLE

-----  
CAN BE MADE TO BURN (FLASH POINT  
GREATER THAN 200F).  
EXTINGUISHING-MEDIA -----  
WATER SPRAY. REGULAR FOAM. DRY  
CHEMICAL. CARBON DIOXIDE.  
SPECIAL FIRE FIGHTING INSTRUCTIONS  
-----

WEAR SELF-CONTAINED BREATHING  
APPARATUS. WEAR STRUCTURAL  
FIREFIGHTERS  
PROTECTIVE CLOTHING.  
NFPA/HMIS CLASSIFICATION HAZARD  
RATING  
HEALTH - 0 / 0 0=LEAST 1=SLIGHT  
FIRE - 1 / 1 2=MODERATE 3=HIGH  
REACTIVITY - 0 / 0  
4=EXTREME

PERSONAL PROTECTION INDEX - X  
SPECIFIC HAZARD: NONE LISTED

### 6. ACCIDENTAL RELEASE MEASURES

CONTAIN SPILL. ADVISE EPA; STATE  
AGENCY IF REQUIRED. ABSORB ON INERT  
MATERIAL. SHOVEL, SWEEP OR VACUUM  
SPILL.

### 7. HANDLING AND STORAGE

NFPA CLASS IIIB STORAGE. WASH  
THOROUGHLY AFTER HANDLING.

### 8. EXPOSURE CONTROL / PERSONAL

#### PROTECTION

CONSULT WITH A HEALTH/SAFETY  
PROFESSIONAL FOR SPECIFIC SELECTION.  
VENTILATION -----  
VENTILATE AS NEEDED TO COMPLY WITH  
EXPOSURE LIMIT. GENERAL DILUTION  
VENTILATION ACCEPTABLE.

#### PERSONAL PROTECTIVE EQUIPMENT

-----

SUPPLIED AIR RESPIRATOR WITH ESCAPE  
BOTTLE OR SCBA.

OTHER -----  
IF CONTACT IS UNAVOIDABLE, WEAR  
CHEMICAL RESISTANT CLOTHING. THE  
FOLLOWING MATERIALS ARE ACCEPTABLE  
AS PROTECTIVE CLOTHING MATERIALS:  
POLYVINYL ALCOHOL(PVA); POLYVINYL  
CHLORIDE(PVC); NEOPRENE; NITRILE;  
VITON; POLYURETHANE; LAUNDER SOILED  
CLOTHES.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

EYE -----  
SPLASH PROOF CHEMICAL GOGGLES  
RECOMMENDED TO PROTECT AGAINST  
SPLASH OF PRODUCT.  
GLOVES -----  
PROTECTIVE GLOVES RECOMMENDED  
WHEN PROLONGED SKIN CONTACT  
CANNOT BE  
AVOIDED. THE FOLLOWING GLOVE  
MATERIALS ARE ACCEPTABLE: POLYVINYL  
CHLORIDE (PVC); NEOPRENE; NITRILE;  
POLYVINYL ALCOHOL; VITON;  
RESPIRATOR -----  
CONCENTRATION-IN-AIR DETERMINES  
PROTECTION NEEDED. USE ONLY NIOSH  
CERTIFIED RESPIRATORY PROTECTION.  
RESPIRATORY PROTECTION USUALLY NOT  
NEEDED UNLESS PRODUCT IS HEATED OR  
MISTED. HALF-MASK AIR PURIFYING  
RESPIRATOR WITH DUST/MIST FILTERS OR  
HEPA FILTER CARTRIDGES IS ACCEPTABLE  
TO 10 TIMES THE EXPOSURE LIMIT.  
FULL-FACE AIR PURIFYING RESPIRATOR  
WITH DUST/MIST FILTERS OR HEPA FILTER  
CARTRIDGES IS  
ACCEPTABLE TO 50 TIMES THE EXPOSURE  
LIMIT. PROTECTION BY AIR PURIFYING  
RESPIRATORS IS LIMITED. USE A POSITIVE  
PRESSURE-DEMAND FULL-FACE  
SUPPLIED AIR RESPIRATOR OR SCBA FOR  
EXPOSURES ABOVE 50X THE EXPOSURE  
LIMIT. IF EXPOSURE IS ABOVE  
IDLH(IMMEDIATELY DANGEROUS TO LIFE  
& HEALTH) OR THERE IS THE POSSIBILITY  
OF AN UNCONTROLLED RELEASE OR  
EXPOSURE  
LEVELS ARE UNKNOWN THEN USE A  
POSITIVE PRESSURE-DEMAND FULL-FACE  
BOILING POINT..... : HIGH WITH (DEG. F)  
\_\_\_\_\_ WIDE RANGE (DEG. C)  
MELTING POINT..... : N/A (DEG. F) \_\_\_\_\_  
N/A (DEG. C)  
SPECIFIC GRAVITY... : 0.87 (WATER=1)  
PACKING DENSITY.... : N/A (KG/M3)  
VAPOR PRESSURE..... : < 0.0001 (MM HG @  
20 DEG C)  
VAPOR DENSITY..... : 10+ (AIR=1)  
SOLUBILITY IN WATER.: NIL (% BY  
VOLUME)  
PH INFORMATION..... : 8.5 AT CONC. N.D.



**MSDS**  
**OIL, 2 CYCLE**

G/L H2O  
 % VOLATILES BY VOL.: NIL  
 EVAPORATION RATE... : 1000X SLOWER  
 (ETHYLETHER=1)  
 OCTANOL/WATER COEFF.: N.D.  
 APPEARANCE..... : GREEN COLORED OIL  
 ODOR..... : SLIGHT ODOR  
 ODOR THRESHOLD..... : N.D. (PPM)  
 VISCOSITY..... : 194 SUS @ 100 DEG F ...  
 37.7 CST @ 40 DEG C  
 MOLECULAR WEIGHT... : N.D. (G/MOLE)  
10. STABILITY AND REACTIVITY  
 STABILITY  
 -----STABLE.  
 INCOMPATIBLE MATERIALS ---- STRONG  
 OXIDIZERS  
 HAZARDOUS DECOMPOSITION  
 -----  
 COMBUSTION WILL PRODUCE CARBON  
 MONOXIDE AND ASPHYXIANTS  
 POLYMERIZATION -----WILL NOT OCCUR.  
11. TOXICOLOGICAL INFORMATION  
 FOR THE PRODUCT -----  
 INHALATION: LOW ACUTE TOXICITY. SKIN:  
 EXPECTED TO BE ACUTELY NON-TOXIC  
 IF ABSORBED. MILD IRRITATION WITH  
 PROLONGED OR REPEATED CONTACT. EYE:  
 MINIMALLY IRRITATING ON CONTACT.  
 ORAL: PRACTICALLY NON-TOXIC.  
 SEVERELY SOLVENT REFINED HEAVY  
 PARAFFINIC PETROLEUM OIL  
 (COMPONENT)  
 INHALATION: LOW ACUTE TOXICITY. SKIN:  
 IATA- PROPER SHIPPING NAME- NO DATA  
 AVAILABLE  
15. REGULATORY INFORMATION  
 SARA 302 THRESHOLD PLANNING  
 QUANTITY. N/A  
 SARA 304 REPORTABLE QUANTITY ..... N/A  
 SARA 311 CATEGORIES- IMMEDIATE  
 (ACUTE) HEALTH EFFECTS.. N  
 DELAYED (CHRONIC) HEALTH EFFECTS.. N  
 FIRE HAZARD ..... N  
 SUDDEN RELEASE OF PRESSURE HAZARD. N  
 REACTIVITY HAZARD ..... N  
 WHEN A COMPONENT OF THIS PRODUCT IS  
 LISTED BELOW, THE REGULATORY LIST ON  
 WHICH IT APPEARS IS INDICATED.  
 THE COMPONENTS OF THIS PRODUCT ARE  
 LISTED ON THE EPA/TSCA INVENTORY OF

PRACTICALLY NON-TOXIC BY  
 ABSORPTION. MAY CAUSE MODERATE  
 IRRITATION WITH PROLONGED AND  
 REPEATED CONTACT.  
 EYE: MINIMALLY IRRITATING ON  
 CONTACT. INGESTION: PRACTICALLY  
 NON-TOXIC IF SWALLOWED.  
 PROPRIETARY (COMPONENT)  
 COMPONENT IDENTITY NOT SPECIFIED: NO  
 TOXICOLOGY STATEMENT AVAILABLE.  
12. ECOLOGICAL INFORMATION  
 AQUATIC TOXICITY -----  
 NO DATA AVAILABLE  
13. DISPOSAL CONSIDERATIONS  
 FOLLOW FEDERAL, STATE AND LOCAL  
 REGULATIONS. NOT A RCRA HAZARDOUS  
 WASTE  
 IF UNCONTAMINATED. IF "USED", RCRA  
 CRITERIA (IGNITABILITY, REACTIVITY,  
 CORROSIVITY, TOXICITY  
 CHARACTERISTICS) MUST BE DETERMINED.  
 DO NOT FLUSH TO DRAIN/ STORM SEWER.  
 CONTRACT TO AUTHORIZED DISPOSAL  
 SERVICE.  
14. TRANSPORTATION INFORMATION  
 DOT- PROPER SHIPPING NAME-  
 PETROLEUM LUBRICATING OIL  
 HAZARD CLASS- NOT REGULATED  
 IDENTIFICATION NUMBER- NOT  
 REGULATED  
 LABEL REQUIRED- NOT REGULATED  
 IMDG- PROPER SHIPPING NAME- NO DATA  
 AVAILABLE  
 CHEMICALS.  
 01=SARA 313                    02=SARA 302/304  
 03=IARC CARCINOGEN  
 04=OSHA CARCINOGEN        05=ACGIH  
 CARCINOGEN        06=NTP CARCINOGEN  
 07=CERCLA 302.4    08=WHMIS  
 CONTROLLED PROD.  
 10=OTHER CARCINOGEN  
 PA=PENNSYLVANIA RTK    NJ=NEW  
 JERSEY RTK    CA=CALIFORNIA PROP 65  
 MA=MASSACHUSETTS RTK  
 MI=MICHIGAN 406    MN=MINNESOTA RTK  
 FL=FLORIDA                    RI=RHODE ISLAND  
 IL=ILLINOIS  
 NY=NEW YORK                    WV=WEST  
 VIRGINIA        CT=CONNECTICUT  
 LA=LOUISIANA                    ME=MAINE



**MSDS**  
**OIL, 2 CYCLE**

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OH=OHIO

16. OTHER INFORMATION

CAUTION] PROLONGED OR REPEATED  
CONTACT WITH USED MOTOR OIL MAY BE  
HARMFUL TO SKIN AND COULD CAUSE  
SKIN CANCER. PROMPTLY WASH AFFECTED  
AREA WITH SOAP AND WATER. WHMIS  
CLASSIFICATION: NOT CONTROLLED

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# MSDS

## DEEP WOODS OFF

### \*\*\* IDENTIFICATION \*\*\*

MSDS RECORD NUMBER : 668986  
PRODUCT NAME(S): DEEP WOODS OFF PUMP  
SPRAY

#### MATERIAL SAFETY DATA SHEET

WHMIS Serial No: 8 Issued: 1993-04-26  
Supersedes: 1993-01-27

### PRODUCT IDENTIFICATION

PRODUCT NAME: DEEP WOODS OFF! PUMP  
SPRAY

PRODUCT USE: HOUSEHOLD INSECT  
REPELLANT

HMS RATING  
HEALTH: 2  
FLAMMABILITY: 3  
REACTIVITY: 0  
SPECIAL WARNING:

### INGREDIENT INFORMATION

WEIGHT %	CAS	INGREDIENT
25	134-62-3	DIETHYLTOLUAMIDE LD50: 1,950 MG/KG (ORAL - RAT) EXP. LIMITS: NOT ESTABLISHED
15 - 40	64-17-5	ETHANOL LD50: 7,060 MG/KG (ORAL - RAT) EXP. LIMITS: 1000 PPM (TLV-TWA ACGIH)

### PHYSICAL DATA

PHYSICAL STATE: LIQUID  
ODOUR/APPEARANCE: CLEAR, COLOURLESS  
LIQUID WITH CHARACTERISTIC FLORAL  
ODOUR  
ODOUR THRESHOLD: NOT AVAILABLE  
SPECIFIC GRAVITY: 0.923 (WATER = 1.0)  
VAPOUR PRESSURE (MM HG): NOT  
AVAILABLE  
VAPOUR DENSITY (AIR=1.0): NOT AVAILABLE  
CARCINOGENICITY : NONE KNOWN  
REPRODUCTIVE TOXICITY : NONE KNOWN  
TERATOGENICITY : NONE KNOWN

WATER SOLUBILITY: DISPERSIBLE  
EVAPORATION RATE: NOT AVAILABLE  
(BUTYL ACETATE = 1.0)  
BOILING POINT (DEG C): 75  
FREEZING POINT (DEG C): NOT AVAILABLE  
PH: 7.5  
COEF. WATER/OIL: NOT AVAIL.

### FIRE AND EXPLOSION INFORMATION

FLASH POINT (DEG C): 25 (TCC)  
FLAMMABLE LIMITS: NOT AVAILABLE  
AUTO-IGNITION TEMP (DEG C): NOT  
APPLICABLE  
FLAMMABILITY CLASSIFICATION :  
FLAMMABLE LIQUID  
EXTINGUISHING MEDIA : CARBON DIOXIDE,  
FOAM, DRY CHEMICAL, "ALCOHOL" FOAM.  
SPECIAL FIREFIGHTING PROCEDURES :  
NORMAL FIRE FIGHTING PROCEDURE MAY  
BE USED. COOL AND USE CAUTION WHEN  
APPROACHING CONTAINERS.  
FIRE FIGHTERS SHOULD WEAR SCBA AND  
PROTECTIVE CLOTHING.  
EXPLOSION DATA : RISK OF EXPLOSION BY  
FIRE OR OTHER SOURCES OF IGNITION.

### TOXICOLOGICAL AND FIRST AID DATA

LD50 : 5,400 MG/KG (ORAL-MALE RAT), 2,510  
MG/KG (ORAL-FEMALE RAT)  
SOURCE: RALTECH SCIENTIFIC SERVICES  
REPORT 795400 LC50 : NOT AVAILABLE  
PRIMARY ROUTE OF ENTRY :  
EYE CONTACT, INHALATION, INGESTION.  
EFFECTS OF ACUTE EXPOSURE :  
MAY CAUSE EYE IRRITATION.  
MAY DRY OR DEFAT SKIN ON PROLONGED  
CONTACT.  
INHALATION MAY CAUSE DIZZINESS AND  
DROWSINESS.  
EFFECTS OF CHRONIC EXPOSURE :  
NOT AVAILABLE  
IRRITANCY OF PRODUCT : MODERATELY  
IRRITATING TO EYES.  
MILDLY IRRITATING TO SKIN ON  
PROLONGED CONTACT.  
SENSITIZATION : NONE KNOWN

MUTAGENICITY :NONE KNOWN

### FIRST AID PROCEDURES



# MSDS

## DEEP WOODS OFF

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EYE CONTACT : FLUSH IMMEDIATELY WITH WATER FOR 15 MINUTES.

IF IRRITATION OCCURS, GET MEDICAL ATTENTION.

SKIN CONTACT : NO SPECIAL REQUIREMENT FOR NORMAL USE.

IF IRRITATION OCCURS, GET MEDICAL ATTENTION.

INHALATION : REMOVE TO FRESH AIR.

ADMINISTER ARTIFICIAL RESPIRATION, IF NEEDED.

INGESTION : DILUTE WITH 1 - 2 GLASSES OF MILK. SEEK MEDICAL AID.

### REACTIVITY DATA

STABILITY : STABLE

CONDITIONS TO AVOID : EXCESSIVE HEAT.

INCOMPATIBILITY : AVOID PLASTIC, RUBBER AND OXIDIZERS.

HAZARDOUS DECOMPOSITION PRODUCTS : WHEN EXPOSED TO FIRE, PRODUCES NORMAL COMBUSTION PRODUCTS.

HAZARDOUS POLYMERIZATION : WILL NOT OCCUR.

CONDITIONS TO AVOID : NOT APPLICABLE

### PREVENTIVE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED :

ELIMINATE ALL SOURCES OF IGNITION.

ABSORB WITH OIL-DRI. SWEEP/SCRAPE UP.

CONTAINERIZE IN STEEL DRUMS.

WASTE DISPOSAL INFORMATION :

KEEP STORAGE CONTAINERS WELL SEALED.

OBSERVE ALL FEDERAL, STATE AND

MUNICIPAL REGULATIONS FOR IGNITABLE WASTE.

### SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION : NOT REQUIRED FOR NORMAL USE.

VENTILATION : ROOM VENTILATION SHOULD BE SUFFICIENT.

PROTECTIVE GLOVES : NOT REQUIRED FOR NORMAL USE. GROSS CONTACT POSSIBLE (E.G. SPILLS): NEOPRENE GLOVE.

EYE PROTECTION : SAFETY GLASSES.

OTHER PROTECTIVE MEASURES :

### SPECIAL PRECAUTIONS

PRECAUTIONARY LABELING : KEEP AWAY FROM SOURCES OF IGNITION.

KEEP AWAY FROM HEAT.

OTHER HANDLING AND STORAGE CONDITIONS : BOND AND GROUND DURING MATERIAL TRANSFER.

DO NOT TRANSFER WITH AIR PRESSURE. KEEP CONTAINER WELL CLOSED WHEN NOT IN USE.

### ADDITIONAL INFORMATION

SHIPPING NAME: ETHANOL SOLUTION

TDG CLASSIFICATION: 3.3

PIN/NIP: 1170

PACKING GROUP:

PLACARD: FLAMMABLE LIQUID

EXEMPTION NAME: CONSUMER COMMODITY

HMS CLASSIFICATION : REGULATED UNDER

P.C.P. ACT NO. 22258

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# MSDS

## INSECT REPELLENT

### SECTION 1. CHEMICAL IDENTIFICATION

CHEMINFO RECORD NUMBER : 333  
CCOHS CHEMICAL NAME : Permethrin  
SYNONYMS :  
3-(2,2-Dichloroethenyl)-2,2-dimethylcyclopropanecarboxylic acid, (3-phenoxyphenyl)methyl ester  
3-Phenoxybenzyl  
(1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate Permethrine  
TRADE NAME(S) :  
Ambush  
Ectiban  
Pounce

### SECTION 2. DESCRIPTION

APPEARANCE AND ODOUR : Colourless crystals or pale yellow-brown viscous liquid, depending on purity. Partially crystallizes at ambient temperature.  
ODOUR THRESHOLD : No information available.  
WARNING PROPERTIES : No information available for evaluation.  
COMPOSITION/PURITY : Permethrin is a pyrethroid, a man-made chemical which is similar to chemicals occurring naturally in plants (pyrethrins). Commercial permethrin is a mixture of 4 isomers (chemical forms). Most technical material is a mixture of approximately 50-60% trans- and 50-40% cis-isomers, but formulations with 75:25 trans:cis ratio are also available. Permethrin may be formulated as emulsifiable or ultra low volume concentrates, dusts, fogs or wettable powders. This material is often only a small percentage of pesticide formulations. The overall physical, chemical and toxicological characteristics of the product may depend on other ingredients such as solvents.

### SECTION 3. HAZARDS IDENTIFICATION

#### POTENTIAL HEALTH EFFECTS

EFFECTS OF SHORT-TERM (ACUTE) EXPOSURE : INHALATION : One study reported disturbances such as nausea, vomiting, irritable behaviour, tremors and muscle weakness might occur.

respiratory tract irritation in a large percentage of workers exposed to permethrin formulations (emulsion or wettable powder).

Symptoms included increased nasal secretion, sneezing, coughing and difficulty breathing and varied with the formulation tested.(12) Other components of products may contribute to the irritation.

SKIN CONTACT : Animal tests show that permethrin is readily absorbed through the skin, but is rapidly broken down in the body and has a low toxicity by this route. There is extensive documentation of a unique skin sensory change caused by permethrin and some other pyrethroids. This is described as a stinging, tingling or burning sensation progressing to numbness in some cases. Usually there is a short delay between exposure and onset of symptoms (30 minutes to a few hours) with a peak in about 8 hours and complete clearance within 24 hours. Inflammation (redness, swelling, blistering) is not apparent. Permethrin tends to produce relatively mild effects.(12-16) Of a group of 4 pyrethroids tested (permethrin, cypermethrin, fenvalerate and flucythrinate), permethrin produced the least amount of skin sensation. Forestry workers exposed to permethrin reported symptoms that were mainly irritative, such as itching and burning of the skin. However, it could not be discerned whether this sensation was an irritative one or a sign of peripheral sensory nerve involvement.

EYE CONTACT : Among forestry workers exposed to permethrin, eye irritation was reported for 7% or 18% of planters, depending on formulation used.(12) There are no reports of eye damage from permethrin contact.

INGESTION : No human cases of ingestion have been reported. Animal data indicates relatively low acute oral toxicity for permethrin. Due to its low toxicity and rapid metabolism, toxic effects are not expected unless there is accidental ingestion of large amounts. In this case, nervous system

CARCINOGENICITY : No information available  
TERATOGENICITY AND EMBRYOTOXICITY : No human information available. No teratogenic or embryotoxic effects in mice.



# MSDS

## INSECT REPELLENT

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REPRODUCTIVE TOXICITY : No information available.

MUTAGENICITY : No human information available. Permethrin was not mutagenic in a variety of short-term tests.

TOXICOLOGICALLY SYNERGISTIC

MATERIALS : No information available.

POTENTIAL FOR ACCUMULATION :

Animal studies indicate rapid breakdown and excretion of this pyrethroid. Thus, the potential for accumulation in humans is considered to be low.

### SECTION 4. FIRST AID MEASURES

INHALATION : If symptoms are experienced, remove source of contamination or move victim to fresh air. Obtain medical advice immediately.

SKIN CONTACT : Symptoms of skin contact are delayed. Therefore, if contact occurs, remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts).

Gently blot or brush away excess chemical quickly.

Wash gently and thoroughly with water and non-abrasive soap. If symptoms occur, obtain medical attention immediately. Completely decontaminate clothing, shoes

and leather goods before reuse, or discard.

EYE CONTACT : Gently blot or brush away excess chemical quickly. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 20 minutes, by the clock, holding the eyelid(s) open. If irritation persists, obtain medical advice immediately.

INGESTION : Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 240 to 300 mL (8 to 10 oz.) of water. If vomiting occurs naturally, rinse mouth and repeat administration of water. Obtain medical attention immediately.

FIRST AID COMMENTS : Consult a physician and/or the nearest Poison Control Center for all No special procedures required for permethrin. Flash point data is not available, but it is probable the material can burn only if strongly heated. Cool fire-exposed containers. Pesticide formulations may contain combustible ingredients. Select extinguishing media and prepare fire fighting procedures appropriate for the product as a whole.

exposures except minor instances of inhalation or skin contact. All first

aid procedures should be periodically reviewed by a physician familiar with the material and its conditions of use in the

workplace. NOTE: Other ingredients in permethrin formulations may cause toxic effects and require specific first aid measures.

NOTE TO PHYSICIANS : Studies with permethrin showed that topical Vitamin E acetate (dl-alpha tocopheryl acetate) reduced or eliminated the sensations from skin

contact. Mephenesin (a muscle relaxant) has been proposed for use in treatment of pyrethroid poisoning. In tests with rats receiving lethal doses of the pyrethroids cismethrin and deltamethrin, all animals survived when treated with mephenesin.

### SECTION 5. FIRE FIGHTING MEASURES

FLASH POINT : No information available. Probably can burn only if strongly heated.

LOWER FLAMMABLE (EXPLOSIVE) LIMIT (LFL/LEL) : Not available

UPPER FLAMMABLE (EXPLOSIVE) LIMIT (UFL/UEL) : Not available

AUTOIGNITION (IGNITION) TEMPERATURE : Not available

EXPLOSION DATA - SENSITIVITY TO MECHANICAL IMPACT : Probably not sensitive.

EXPLOSION DATA - SENSITIVITY TO STATIC CHARGE : Information not available

COMBUSTION AND THERMAL DECOMPOSITION PRODUCTS : Carbon

monoxide, carbon dioxide, hydrogen chloride gas.

FIRE HAZARD COMMENTS : Permethrin may emit toxic hydrogen chloride gas at high temperatures.

EXTINGUISHING MEDIA : Carbon dioxide, dry chemical powder, alcohol foam, polymer foam, water fog.

FIRE FIGHTING INSTRUCTIONS :

### SECTION 6. ACCIDENTAL RELEASE MEASURES

PRECAUTIONS : Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. Wear adequate personal protective equipment. Ventilate area. Notify occupational health and safety and environmental

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# MSDS

## INSECT REPELLENT

authorities.

CLEAN-UP :Prevent material from entering sewers or waterways. Do not touch spilled material. Stop or reduce leak if safe to do so. Contain spill with earth, sand or absorbent material which does not react with spilled material. Small spills (liquid): Soak up spill with absorbent material which does not react with spilled chemical. Put material in suitable, covered, labelled containers. Small spills (solid): Shovel into clean, dry, labelled containers and cover. Large spills: Contact fire and emergency services and supplier for advice.

### SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

RESPIRATORY PROTECTION GUIDELINES :No specific guidelines are available. Contact manufacturer or supplier for advice.The NIOSH recommendations for PYRETHRUM may be applicable. See CHEMINFO record number 311 (Pyrethrins) for details.

EYE/FACE PROTECTION : No specific requirement, but it is good practice to wear chemical safety goggles. During pesticide application, a full-face shield may also be required to ensure adequate protection.

SKIN PROTECTION : No specific requirement, but it is good practice to prevent skin contact. During pesticide application, this will require the use of impervious gloves, overalls, boots and/or other resistant protective clothing.

RESISTANCE OF MATERIALS FOR PROTECTIVE CLOTHING : No specific information is available. Contact manufacturer/supplier for advice. Polyvinyl alcohol (PVA) provides good resistance to pyrethrins and

STABILITY : Stable to heat (more than 2 years at 50 deg C).(2) Relatively stable in sunlight.(17) More stable in acid than alkaline media with optimum stability at about pH 4.(2)

HAZARDOUS POLYMERIZATION : Does not occur

HAZARDOUS DECOMPOSITION PRODUCTS : None known

INCOMPATIBILITY - MATERIALS TO AVOID :  
STRONG OXIDIZING AGENTS - May increase

related materials (higher monobasic carboxylic esters). Consider solvent base when selecting resistant materials for pyrethroid formulations. NOTE: Resistance of specific materials can vary from product to product. Evaluate resistance under conditions of use and maintain clothing carefully.

### SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

MELTING POINT: 34-35 deg C (pure)

BOILING POINT: Very high (approximately 200 deg C at 0.008 mm Hg); probably decomposes on heating.

RELATIVE DENSITY (SPECIFIC GRAVITY) : 1.19-1.27 at 20 deg C (water = 1)

SOLUBILITY IN WATER : Practically insoluble (0.2 mg/L at 20 deg C)

SOLUBILITY IN OTHER LIQUIDS :

Readily soluble in common organic solvents such as alcohols, acetone, ether, chloroform, methylene chloride, xylene; moderately soluble in ethylene glycol.

VAPOUR DENSITY: Not applicable

VAPOUR PRESSURE: Very low ( $3.4 \times 10^{-7}$  mm Hg at 25 deg C)

SATURATION VAPOUR CONCENTRATION : Not applicable

EVAPORATION RATE : Practically zero.

pH VALUE: Not available

CRITICAL TEMPERATURE: Not applicable

COEFFICIENT OF OIL/WATER DISTRIBUTION (PARTITION COEFFICIENT) : Log P(oct) = 6.5. Also reported as 3.48.

### SECTION 10. STABILITY AND REACTIVITY

the risk of fire. STRONG BASES - Cause decomposition of material. CALCIUM NITRATE CORROSIVITY TO METALS : Not corrosive to aluminum.

STABILITY AND REACTIVITY COMMENTS :Permethrin is more stable to sunlight than natural pyrethrins, but some degradation does occur.

### SECTION 13. DISPOSAL CONSIDERATIONS



# MSDS

## INSECT REPELLENT

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Pyrethroids are highly toxic to fish. Do not release to water. Disposal by controlled incineration or secure landfill may be acceptable. Treat with alkali (lime) before landfilling. Decontamination of waste material should only be done by specially-trained personnel using appropriate facilities and protective equipment. Incineration must be carried

out in approved facilities equipped with adequate emission control devices. Comply with applicable federal, state and local government regulations regarding disposal.

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**MSDS**  
**UNLEADED GASOLINE**

\*\*\* IDENTIFICATION \*\*\*

MSDS RECORD NUMBER : 802164  
 PRODUCT NAME(S) : CFR 40-86-96 RON  
 UNLEADED GASOLINE + 15% MTBE  
 PRODUCT IDENTIFICATION : PRODUCT  
 CODE R00000573200  
 DATE OF MSDS : 1994-09-13

SYNONYMS..... : UNLEADED PREMIUM  
 GASOLINE  
 CAS REGISTRY NO: SEE SEC. 2  
 CAS NAME..... : NO CLASSIFICATION -  
 MIXTURE  
 CHEMICAL FAMILY: MOTOR FUEL.

\*\*\* MATERIAL SAFETY DATA \*\*\*

EMERGENCY PHONE NUMBERS (AFTER  
 NORMAL BUSINESS HOURS)  
 CHEMTREC. 1-800-424-9300

PRIMARY APPLICATION- MOTOR FUEL

2. COMPOSITION / INFORMATION ON INGREDIENTS

EXPOSURE GUIDELINES

COMPONENT/CAS NO.	OSHA		ACGIH		TWA		STEL		UNIT
	LO%	HI%	TWA	STEL	TWA	STEL	TWA	STEL	

LIMITS FOR THE PRODUCT:

			300	500	300	500		
XYLENE								PPM
1330-20-7	.00	25.00	100	150	100	150		PPM
TERT-BUTYL ALCOHOL								
75-65-0	.00	10.00	100	150	100	150		PPM
MTBE								
1634-04-4	15.00	20.00					100 150	PPM
TOLUENE								
108-88-3	.00	30.00	100	150	50			PPM
BENZENE								
71-43-2	.10	4.90	1	5	10			PPM
LIGHT PETROLEUM DISTILLATE								
8006-61-9	.00	84.00	300	500	300	500		PPM
CUMENE								
98-82-8	.00	1.00	50		50			PPM
ETHYL BENZENE								
100-41-4	.00	5.00	100	125	100	125		PPM
N-HEXANE								
110-54-3	.00	5.00	50		50			PPM
NAPHTHALENE								
91-20-3	.00	5.00	10	15	10	15		PPM
CYCLOHEXANE								
110-82-7	.00	9.00	300		300			PPM
1,2,4-TRIMETHYLBENZENE								
95-63-6	.00	5.00	25		25			PPM

ADDITIONAL EXPOSURE LIMITS

OTHER LIMIT- LIMIT IS DEPENDENT ON BENZENE, SEE SECTION 10

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW  
 DANGER EXTREMELY FLAMMABLE LIQUID &



# MSDS

## UNLEADED GASOLINE

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VAPOR - VAPOR MAY CAUSE FLASH FIRE.

HARMFUL IF INHALED. HIGH VAPOR CONCENTRATIONS MAY CAUSE DIZZINESS. MAY CAUSE SKIN IRRITATION.

HARMFUL OR FATAL IF SWALLOWED. PULMONARY ASPIRATION HAZARD-CAN ENTER LUNGS AND CAUSE DAMAGE. CONTAINS MATERIAL WHICH CAN CAUSE CANCER.

APPEARANCE-- COLORLESS LIQUID.  
ODOR-- GASOLINE ODOR

### POTENTIAL HEALTH EFFECTS

PRIMARY ROUTES OF ENTRY- INHALATION( X ) SKIN( X ) EYE( X ) INGESTION(X )

INHALATION: EXCESSIVE EXPOSURES MAY CAUSE IRRITATION TO EYES, NOSE, THROAT AND LUNGS. RESPIRATORY TRACT; CENTRAL NERVOUS SYSTEM (BRAIN) EFFECTS; HEADACHES, NAUSEA; DIZZINESS, LOSS OF BALANCE AND COORDINATION; UNCONSCIOUSNESS, COMA; RESPIRATORY FAILURE AND DEATH. REPEATED EXCESSIVE EXPOSURES MAY CAUSE BLOOD DISORDERS SUCH AS ANEMIA & LEUKEMIA. CONTAINS A MATERIAL WHICH HAS BEEN RELATED TO CANCER IN HUMANS.

### SKIN

SKIN ABSORPTION OF MATERIAL MAY PRODUCE SYSTEMIC TOXICITY. MAY CAUSE MODERATE IRRITATION WITH PROLONGED OR REPEATED CONTACT.

### EYE

CONTACT WITH THE EYE MAY CAUSE MILD IRRITATION.

DO NOT INDUCE VOMITING] DO NOT GIVE LIQUIDS] OBTAIN EMERGENCY MEDICAL ATTENTION. SMALL AMOUNTS WHICH ACCIDENTALLY ENTER MOUTH SHOULD BE RINSED

OUT UNTIL TASTE OF IT IS GONE.

### 5. FIRE FIGHTING MEASURES

### INGESTION

HARMFUL OR FATAL IF SWALLOWED. INGESTION OF THIS MATERIAL MAY CAUSE ABDOMINAL PAIN; PULMONARY ASPIRATION HAZARD IF SWALLOWED AND/OR VOMITING OCCURS - CAN ENTER LUNGS AND CAUSE DAMAGE. CONTAINS MATERIAL THAT HAS BEEN RELATED TO CANCER IN HUMANS.

CARCINOGEN LISTED BY-IARC(YES) NTP(NO) OSHA(YES) ACGIH(NO) OTHER(NO)

PRE-EXISTING MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE- DISORDERS AND DISEASES OF THE SKIN, EYE, BLOOD FORMING ORGANS, NERVOUS SYSTEM AND OR PULMONARY SYSTEM, LUNG (E.G. ASTHMA-LIKE CONDITIONS).

### 4. FIRST AID MEASURES

#### INHALATION

MOVE PERSON TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION, OBTAIN MEDICAL ASSISTANCE.

#### SKIN

WASH WITH SOAP AND WATER UNTIL NO ODOR REMAINS. IF REDNESS OR SWELLING DEVELOPS, OBTAIN MEDICAL ASSISTANCE. IMMEDIATELY REMOVE SOAKED CLOTHING. WASH CLOTHING BEFORE REUSE.

#### EYE

FLUSH WITH WATER FOR AT LEAST 15 MINUTES. IF IRRITATION PERSISTS, OBTAIN MEDICAL ASSISTANCE.

#### INGESTION

FLASH POINT: -40 CLOSED CUP (DEG. F); -40 CLOSED CUP (DEG. C)  
AUTOIGNITION TEMP.: APPROX. 750 (DEG. F); APPROX. 400 (DEG. C)

#### ---FLAMMABLE LIMITS IN AIR---

LOWER EXPLOSIVE LIMIT (LEL): 1.5 %

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# MSDS

## UNLEADED GASOLINE

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VOLUME  
UPPER EXPLOSIVE LIMIT (UEL): 7.6 %  
VOLUME

### FIRE AND EXPLOSION HAZARDS

EXTREMELY FLAMMABLE LIQUID (FLASH POINT LESS THAN 20F)

### EXTINGUISHING-MEDIA

WATER SPRAY. REGULAR FOAM. DRY CHEMICAL. CARBON DIOXIDE.

### SPECIAL FIRE FIGHTING INSTRUCTIONS

COOL TANK/ CONTAINER. WEAR SELF-CONTAINED BREATHING APPARATUS. WEAR STRUCTURAL FIREFIGHTERS PROTECTIVE CLOTHING.

NFPA/HMIS CLASSIFICATION

HAZARD RATING

HEALTH - 1 / 1 FIRE - 3 / 3

0=LEAST 1=SLIGHT 2=MODERATE

3=HIGH 4=EXTREME

REACTIVITY - 0 / 0

PERSONAL PROTECTION INDEX - X

SPECIFIC HAZARD: FLAMMABLE

### 6. ACCIDENTAL RELEASE MEASURES

PREVENT IGNITION; STOP LEAK; VENTILATE AREA. CONTAIN SPILL. USE WATER SPRAY TO DISPERSE VAPORS. KEEP UPWIND OF LEAK. FOR LARGE SPILL, LEAK OR RELEASE. USE PERSONAL PROTECTIVE EQUIPMENT STATED IN SECTION 8. ADVISE EPA; STATE PROTECTIVE GLOVES RECOMMENDED TO PROTECT AGAINST CONTACT WITH PRODUCT. THE FOLLOWING GLOVE MATERIALS ARE ACCEPTABLE: POLYETHYLENE; NEOPRENE; NITRILE; POLYVINYL ALCOHOL; VITON;

### RESPIRATOR

CONCENTRATION-IN-AIR DETERMINES PROTECTION NEEDED. USE ONLY NIOSH CERTIFIED RESPIRATORY PROTECTION. HALF-MASK AIR PURIFYING RESPIRATOR

AGENCY IF REQUIRED. ABSORB ON INERT MATERIAL. SHOVEL, SWEEP OR VACUUM SPILL.

### 7. HANDLING AND STORAGE

KEEP AWAY FROM HEAT, SPARKS AND FLAME. KEEP CONTAINER TIGHTLY CLOSED. KEEP IN WELL VENTILATED SPACE. NFPA CLASS IA STORAGE. CONSULT NFPA AND OSHA CODES. TRANSFER OPERATIONS MUST BE ELECTRICALLY GROUNDED TO DISSIPATE STATIC BUILDUP. AVOID PROLONGED BREATHING OF MIST OR VAPOR. AVOID PROLONGED OR REPEATED CONTACT WITH SKIN. AVOID CONTACT WITH EYES. WASH THOROUGHLY AFTER HANDLING. NEVER SIPHON BY MOUTH.

### 8. EXPOSURE CONTROL / PERSONAL PROTECTION

CONSULT WITH A HEALTH/SAFETY PROFESSIONAL FOR SPECIFIC SELECTION.

### VENTILATION

USE ONLY WITH ADEQUATE VENTILATION. EXPLOSION PROOF VENTILATION EQUIPMENT REQUIRED.

### PERSONAL PROTECTIVE EQUIPMENT

#### EYE

SPLASH PROOF CHEMICAL GOGGLES OR FULL FACE SHIELD RECOMMENDED TO PROTECT AGAINST SPLASH OF PRODUCT.

#### GLOVES

WITH ORGANIC VAPOR CARTRIDGES IS ACCEPTABLE TO 10 TIMES THE EXPOSURE LIMIT. FULL-FACE AIR PURIFYING RESPIRATOR WITH ORGANIC VAPOR CARTRIDGES

IS ACCEPTABLE TO 50 TIMES THE EXPOSURE LIMIT NOT TO EXCEED THE CARTRIDGE LIMIT OF 1000 PPM. PROTECTION BY AIR PURIFYING RESPIRATORS IS LIMITED. USE A POSITIVE PRESSURE-DEMAND FULL-FACE SUPPLIED AIR RESPIRATOR OR SCBA FOR EXPOSURES ABOVE 50X THE EXPOSURE

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# MSDS

## UNLEADED GASOLINE

LIMIT. IF EXPOSURE IS ABOVE IDLH(IMMEDIATELY DANGEROUS TO LIFE & HEALTH) OR THERE IS THE POSSIBILITY OF AN UNCONTROLLED RELEASE OR EXPOSURE LEVELS ARE UNKNOWN THEN USE A POSITIVE PRESSURE-DEMAND FULL-FACE SUPPLIED AIR RESPIRATOR WITH ESCAPE BOTTLE OR SCBA.

### OTHER

IF CONTACT IS UNAVOIDABLE, WEAR CHEMICAL RESISTANT CLOTHING. THE FOLLOWING MATERIALS ARE ACCEPTABLE AS PROTECTIVE CLOTHING MATERIALS: POLYETHYLENE; POLYVINYL ALCOHOL(PVA); NEOPRENE; NITRILE; VITON; POLYURETHANE; SAFETY SHOWER AND EYE WASH AVAILABILITY RECOMMENDED. LAUNDRY SOILED CLOTHES. FOR NON-FIRE EMERGENCIES, POSITIVE PRESSURE SELF-CONTAINED BREATHING APPARATUS (SCBA) & STRUCTURAL FIREFIGHTERS' PROTECTIVE CLOTHING WILL PROVIDE LIMITED PROTECTION.

### 9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT..... : <100 - 435 (DEG. F) <38 - 223 (DEG. C)  
MELTING POINT..... : N/A  
SPECIFIC GRAVITY... : 0.74 (WATER=1)  
PACKING DENSITY.... : N/A (KG/M3)  
VAPOR PRESSURE..... : 325 TO 525 (MM HG @ 20 DEG C)

INHALATION: OVEREXPOSURE MAY CAUSE EYE & RESPIRATORY TRACT IRRITATION, CNS (BRAIN) EFFECTS, DIZZINESS, LOSS OF BALANCE & COORDINATION, COMA, UNCONSCIOUSNESS, DEATH. CONTAINS

BENZENE: PROLONGED/REPEATED OVER-EXPOSURE TO BENZENE CAN CAUSE BLOOD DISORDERS RANGING FROM ANEMIA TO LEUKEMIA. SKIN: PROLONGED/WIDESPREAD CONTACT MAY CAUSE ADVERSE EFFECT, IRRITATION. EYE: MILD IRRITANT.

ORAL: HARMFUL/FATAL IF SWALLOWED. ASPIRATION HAZARD--CAN ENTER LUNGS & CAUSE DAMAGE. LIFETIME INHALATION

VAPOR DENSITY..... : 4 (AIR=1)  
SOLUBILITY IN WATER.: SLIGHT (% BY VOLUME)  
PH INFORMATION..... : N/A AT CONC. N/A G/L H2O  
% VOLATILES BY VOL.: 100  
EVAPORATION RATE... : RAPID & VARIES (ETHYL ETHER=1)  
OCTANOL/WATER COEFF.: N.D.  
APPEARANCE..... : COLORLESS LIQUID.  
ODOR..... : GASOLINE ODOR  
ODOR THRESHOLD..... : 15(EST) (PPM)  
VISCOSITY..... : N.D. SUS @ N.D DEG F ... N.D. CST @ N.D DEG C  
MOLECULAR WEIGHT... : N.D. (G/MOLE)

### 10. STABILITY AND REACTIVITY

#### STABILITY

STABLE. CONDITIONS TO AVOID-SOURCES OF IGNITION.  
INCOMPATIBLE MATERIALS  
STRONG OXIDIZERS  
HAZARDOUS DECOMPOSITION  
CARBON MONOXIDE AND ASPHYXIANTS  
ARE PRODUCED BY FIRE IGNITION

#### POLYMERIZATION

WILL NOT OCCUR.

### 11. TOXICOLOGICAL INFORMATION

FOR THE PRODUCT  
CAUSED LIVER TUMORS (FEMALE MICE)--API STUDY ON AN UNLEADED GASOLINE.  
GASOLINE ENGINE EXHAUST CLASSIFIED AS POSSIBLE (IARC 2B) CARCINOGEN (INADEQUATE EVIDENCE EXISTS IN ANIMALS & HUMANS).

XYLENE (COMPONENT) INHALATION: VAPOR HARMFUL] OVEREXPOSURE TO HIGH CONCENTRATIONS CAN CAUSE EYE, NOSE, THROAT, LUNG IRRITATION; CNS (BRAIN) EFFECTS,  
DIZZINESS, DIFFICULTY IN BREATHING, UNCONSCIOUSNESS, COMA AND DEATH. REPORTS OF HEART IRREGULARITIES FROM MASSIVE EXPOSURES.



# MSDS

## UNLEADED GASOLINE

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PROLONGED OVEREXPOSURES CAN CAUSE BRAIN, LIVER, KIDNEY EFFECTS/DAMAGE.

SKIN: CAN BE ABSORBED. REPEATED/PROLONGED CONTACT IS IRRITATING. EYES:

IRRITANT. ORAL: HARMFUL OR FATAL IF SWALLOWED. PULMONARY ASPIRATION HAZARD-CAN ENTER LUNGS AND CAUSE DAMAGE. IN RATS, PROLONGED BREATHING OF 500 PPM-FETAL EFFECTS BUT NO BIRTH DEFECTS; NO EFFECTS AT 400 PPM. HIGH ORAL DOSE WAS TOXIC TO PREGNANT MICE; CLEFT PALATE IN FETUSES.

### TERT-BUTYL ALCOHOL (COMPONENT)

INHALATION: VAPOR HARMFUL] OVEREXPOSURE TO HIGH CONCENTRATIONS MAY CAUSE EYE, NOSE, THROAT, LUNG IRRITATION; CNS (BRAIN) EFFECTS, HEADACHE, NAUSEA, DIZZINESS, DROWSINESS, VOMITING, FATIGUE, BLURRED VISION, LOSS OF BALANCE, UNCONSCIOUSNESS.

EYE CONTACT: IRRITATION. ORAL: MODERATE ACUTE TOXICITY. HARMFUL OR FATAL IF SWALLOWED AND/OR VOMITING OCCURS BECAUSE IT CAN ENTER LUNGS AND CAUSE DAMAGE--PULMONARY ASPIRATION HAZARD. LIFETIME OVEREXPOSURES AT HIGH CONCENTRATIONS: 3000 PPM & HIGHER--RATS: DEATH, KIDNEY DAMAGE, AND KIDNEY TUMORS (MALES); AT 8000 PPM-- LIVER TUMORS IN FEMALE MICE. MICE: MATERNAL TOXICITY & FETAL EFFECTS AT 4000 PPM. HUMAN EXPOSURES AT THESE HIGH CONCENTRATIONS ARE HIGHLY UNLIKELY.

TOLUENE (COMPONENT) INH: VAPOR HARMFUL] OVEREXPOSURE TO HIGH CONCENTRATIONS: EYE, NOSE, THROAT, LUNG IRRITATION; CNS (BRAIN) EFFECTS, DIZZINESS, DIFFICULTY IN BREATHING, COMA, DEATH. REPORTS OF HEART BEAT IRREGULARITIES FROM MASSIVE EXPOSURE. PROLONGED OVEREXPOSURE CAN CAUSE BRAIN, LIVER, KIDNEY EFFECTS/DAMAGE. SKIN: CAN BE ABSORBED. PROLONGED CONTACT IS IRRITATING.

SKIN: SLIGHT IRRITANT.

EYES: SEVERE IRRITATION WITH CONTACT.

ORAL: MODERATELY TOXIC.

SYMPTOMS SIMILAR TO INHALATION. HARMFUL OR FATAL IF SWALLOWED. PULMONARY ASPIRATION HAZARD IF SWALLOWED AND/OR VOMITING OCCURS - CAN ENTER LUNGS AND CAUSE DAMAGE. CAUSED TOXICITY/DAMAGE TO FETUS WHEN REPEATEDLY FED AT VERY HIGH CONCENTRATIONS TO PREGNANT MICE.

MTBE (COMPONENT) INHALATION: MAY CAUSE EYE & RESPIRATORY TRACT IRRITATION, COUGHING, SHORTNESS OF BREATH, CNS (BRAIN) EFFECTS, HEADACHE, NAUSEA, DIZZINESS, INCOORDINATION. SKIN: PROLONGED/REPEATED CONTACT MAY CAUSE IRRITATION.

EYE: IRRITATION.

ORAL: HARMFUL OR FATAL IF SWALLOWED. PULMONARY ASPIRATION HAZARD-CAN ENTER LUNG & CAUSE DAMAGE. PREG: MAY CAUSE MENTAL AND/OR GROWTH RETARDATION IN CHILDREN OF FEMALE SOLVENT ABUSERS (SNIFFERS); IN RATS PROLONGED BREATHING WAS TOXIC TO FETUSES & MOTHERS - 1500 PPM; NO BIRTH DEFECTS - 5000 PPM. NO EFFECTS - 750 PPM.

BENZENE (COMPONENT) INHALATION: VAPOR HARMFUL] OVEREXPOSURE TO HIGH CONCENTRATIONS CAN CAUSE CENTRAL NERVOUS SYSTEM (BRAIN) EFFECTS, HEADACHE, DIZZINESS, DIFFICULTY IN BREATHING, UNCONSCIOUSNESS, COMA, DEATH. THERE ARE REPORTS OF HEART IRREGULARITIES FROM MASSIVE EXPOSURES. IARC GROUP 1- HUMAN CANCER HAZARD. REPEATED PROLONGED INHALATION CAN CAUSE BLOOD DISORDERS-ANEMIA TO LEUKEMIA.

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# MSDS

## UNLEADED GASOLINE

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CANCER-ANIMAL STUDIES. CHANGES IN CHROMOSOMES. FETAL EFFECTS IN ANIMAL STUDIES AT REPEATED/PROLONGED EXPOSURES.

SKIN: CAN BE ABSORBED; IRRITATING.

EYE: SEVERE IRRITATION POSSIBLE.

ORAL: POISON] HARMFUL OR FATAL IF SWALLOWED. PULMONARY ASPIRATION HAZARD- CAN ENTER LUNGS AND CAUSE DAMAGE.

LIGHT PETROLEUM DISTILLATE (COMPONENT) INHALATION: OVEREXPOSURE MAY CAUSE EYE, NOSE, THROAT, RESPIRATORY TRACT IRRITATION; CNS (BRAIN) EFFECTS, NAUSEA, INCOORDINATION, UNCONSCIOUSNESS, DEATH. SKIN: LOW ACUTE TOXICITY. CAN BE ABSORBED. MODERATE IRRITATION. EYE: MILD IRRITANT.

ORAL: MODERATE ACUTE TOXICITY. HARMFUL OR FATAL IF SWALLOWED. PULMONARY ASPIRATION HAZARD - CAN ENTER LUNGS AND CAUSE DAMAGE. OVEREXPOSURE BY INHALATION/INGESTION MAY CAUSE LIVER, KIDNEY, SPLEEN AND LUNG EFFECTS/DAMAGE. EQUIVOCAL RESULTS IN ANIMAL STUDY REPORTING BIRTH DEFECTS & EMBRYONAL MORTALITY. CONFLICTING RESULTS IN GENETIC TESTS.

ETHYL BENZENE (COMPONENT)

INHALATION: OVEREXPOSURE TO HIGH CONCENTRATIONS CAN CAUSE EYE, NOSE, THROAT & RESPIRATORY IRRITATION, CENTRAL NERVOUS SYSTEM (BRAIN) EFFECTS, DIZZINESS, LOSS OF BALANCE & COORDINATION, UNCONSCIOUSNESS, RESPIRATORY FAILURE & DEATH. PROLONGED BREATHING CAN CAUSE LIVER AND KIDNEY EFFECTS.

SKIN: LOW ACUTE TOXICITY. ABSORBABLE

DIZZINESS, UNCONSCIOUSNESS, COMA, RESPIRATORY FAILURE, DEATH. SKIN: IRRITATION WITH PROLONGED AND REPEATED CONTACT.

EYE: MILD TO MODERATE IRRITATION. ORAL: HARMFUL OR FATAL IF SWALLOWED DUE TO A PULMONARY ASPIRATION HAZARD IF SWALLOWED AND/OR VOMITING OCCURS - CAN ENTER LUNGS AND CAUSE DAMAGE.

CUMENE (COMPONENT) INHALATION: VAPOR HARMFUL] OVEREXPOSURE TO HIGH CONCENTRATIONS CAN CAUSE EYE, NOSE, THROAT, RESPIRATORY TRACT IRRITATION, CNS (BRAIN) EFFECTS, NAUSEA, HEADACHE, DIZZINESS, DIFFICULTY IN BREATHING, THROUGH SKIN. MODERATE IRRITATION.

EYE: MODERATE IRRITANT.

ORAL: HARMFUL OR FATAL IF SWALLOWED. PULMONARY ASPIRATION HAZARD IF SWALLOWED AND/OR VOMITING OCCURS-CAN ENTER LUNGS AND CAUSE DAMAGE. PROLONGED OVEREXPOSURE OF 1000 PPM CAUSED MATERNAL AND FETAL TOXICITY.

N-HEXANE (COMPONENT) INHALATION: OVEREXPOSURE TO HIGH CONCENTRATIONS CAN CAUSE EYE, NOSE, THROAT, RESPIRATORY TRACT IRRITATION; CNS (BRAIN) EFFECTS, DIZZINESS, CONFUSION, COMA.

SKIN: CAN BE ABSORBED. PROLONGED AND REPEATED CONTACT MAY CAUSE IRRITATION, BURNING SENSATION, ITCHING, BLISTERS.

EYE: IRRITATING; REPEATED EXPOSURE MAY CAUSE VISUAL DISTURBANCE.

INGESTION: ASPIRATION HAZARD IF SWALLOWED AND/OR VOMITING OCCURS - CAN ENTER LUNGS AND CAUSE DAMAGE.

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# MSDS

## UNLEADED GASOLINE

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PROLONGED EXPOSURES CAUSE HARM TO THE CENTRAL NERVOUS SYSTEM PRODUCING A LACK OF FEELING IN EXTREMITIES (HANDS AND FEET) AND MORE SEVERE NERVE DAMAGE (PERIPHERAL NEUROPATHY).

### NAPHTHALENE (COMPONENT)

INHALATION: VAPORS MAY CAUSE RESPIRATORY TRACT IRRITATION, HEADACHE, CONFUSION, EXCITEMENT, PROFUSE SWEATING, ABDOMINAL PAIN, VOMITING, DIARRHEA.

KIDNEY INJURY MAY ALSO OCCUR. MAY CAUSE GASTROINTESTINAL IRRITATION, VOMITING, AND DIARRHEA.

### CYCLOHEXANE (COMPONENT)

INHALATION: OVEREXPOSURE TO HIGH CONCENTRATIONS CAN CAUSE EYE, NOSE, THROAT, RESPIRATORY IRRITATION; CNS (BRAIN) EFFECTS, HEADACHE, DIZZINESS, EXCITEMENT, DIFFICULTY BREATHING, FATIGUE, INCOORDINATION, ANESTHESIA, UNCONSCIOUSNESS, DEATH.

SKIN: LOW ACUTE TOXICITY. MAY BE IRRITATING WITH PROLONGED AND REPEATED CONTACT.

EYE: MAY CAUSE MILD IRRITATION WITH CONTACT.

ORAL: MODERATE ACUTE TOXICITY. INGESTION OF LARGE QUANTITIES MAY CAUSE EFFECTS SIMILAR TO INHALATION. HARMFUL OR FATAL IF SWALLOWED AND/OR VOMITING OCCURS BECAUSE IT CAN ENTER LUNGS AND CAUSE DAMAGE--PULMONARY ASPIRATION HAZARD.

### 1,2,4-TRIMETHYLBENZENE (COMPONENT)

INHALATION: MODERATELY TOXIC. VAPOR OR MIST IRRITATES THE EYES, MUCOUS MEMBRANES, RESPIRATORY TRACT. OVEREXPOSURE MAY CAUSE CENTRAL NERVOUS SYSTEM (BRAIN) EFFECTS, NARCOTIC EFFECTS, NAUSEA, HEADACHE, DIZZINESS, INCOORDINATION, UNCONSCIOUSNESS, COMA, DEATH.

SKIN: MAY BE ABSORBED THROUGH THE SKIN. MAY CAUSE IRRITATION AND DERMATITIS. CAN CAUSE ALLERGIC SKIN REACTION.

EYE: VAPOR CAUSES IRRITATION AT 15 PPM. CONTACT MAY CAUSE IRRITATION, CONJUNCTIVITIS, CORNEAL OPACITY. REPORTED TO CAUSE CATARACTS.

ORAL: MODERATELY TOXIC IF SWALLOWED. BLOOD EFFECTS (HEMOLYSIS), LIVER &

SKIN: CAN BE ABSORBED. CONTACT MAY CAUSE IRRITATION AND DERMATITIS. EYE: IRRITATING

INGESTION: MODERATELY TOXIC. SYMPTOMS SIMILAR TO INHALATION. HARMFUL OR FATAL IF SWALLOWED. PULMONARY ASPIRATION HAZARD--HARMFUL OR FATAL BECAUSE IT CAN ENTER THE LUNGS AND CAUSE DAMAGE.

## 12. ECOLOGICAL INFORMATION

AQUATIC TOXICITY: GASOLINE SPILLS ARE TOXIC TO FISH AND AQUATIC FLORA.

## 13. DISPOSAL CONSIDERATIONS

FOLLOW FEDERAL, STATE AND LOCAL REGULATIONS. RCRA HAZARDOUS WASTE. DO NOT FLUSH TO DRAIN/ STORM SEWER. CONTACT TO AUTHORIZED DISPOSAL SERVICE.

## 14. TRANSPORTATION INFORMATION

DOT- PROPER SHIPPING NAME- GASOLINE HAZARD CLASS- 3 (FLAMMABLE LIQUID) IDENTIFICATION NUMBER- UN1203 LABEL REQUIRED- PG II, PLACARD; FLAMMABLE LIQUID IMDG- PROPER SHIPPING NAME- GASOLINE IATA- PROPER SHIPPING NAME- GASOLINE

## 15. REGULATORY INFORMATION

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**MSDS**  
**UNLEADED GASOLINE**

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SARA 302 THRESHOLD PLANNING QUANTITY.  
N/A

SARA 304 REPORTABLE QUANTITY ..... 204  
POUNDS

SARA 311 CATEGORIES- IMMEDIATE (ACUTE)

WHEN A PRODUCT AND/OR COMPONENT IS LISTED BELOW, THE REGULATORY LIST ON WHICH IT APPEARS IS INDICATED.

FOR THE PRODUCT - FL MA MN NJ 03 04  
XYLENE - FL IL MA ME MN NJ PA RI 01 07  
TERT-BUTYL ALCOHOL - FL MA MN NJ PA 01  
MTBE - MA NJ PA 01 07  
TOLUENE - CA FL MA MN NJ PA 01 07  
BENZENE - CA FL MA MN NJ PA 01 03 04 06 07  
10  
LIGHT PETROLEUM DISTILLATE - FL MA MN  
NJ  
CUMENE - FL MA MN NJ PA 01 07  
ETHYL BENZENE - FL MA MN NJ PA 01 07  
N-HEXANE - FL MA MN NJ PA  
NAPHTHALENE - FL MA MN NJ PA 01 07  
CYCLOHEXANE - FL MA MN NJ PA 01 07  
1,2,4-TRIMETHYLBENZENE - MA NJ PA 01

01=SARA 313  
02=SARA 302/304  
03=IARC CARCINOGEN  
04=OSHA CARCINOGEN  
05=ACGIH CARCINOGEN  
06=NTP CARCINOGEN  
07=CERCLA 302.4  
08=WHMIS CONTROLLED PROD.  
10=OTHER CARCINOGEN

THIS PRODUCT OR ALL COMPONENTS OF THIS PRODUCT ARE LISTED ON THE U.S. TSCA INVENTORY.

16. OTHER INFORMATION

PRECAUTIONARY LABELING FOR PUMPS, PORTABLE CONTAINERS, AND DRUMS IS REQUIRED. A "HAZARDOUS WHEN EMPTY" PICTOGRAM AND D.O.T. FLAMMABLE LIQUID LABEL ARE ALSO REQUIRED FOR DRUMS. BECAUSE BENZENE IS PRESENT IN THIS

HEALTH EFFECTS.. Y  
DELAYED (CHRONIC) HEALTH EFFECTS.. Y  
FIRE HAZARD ..... Y  
SUDDEN RELEASE OF PRESSURE HAZARD. N  
REACTIVITY HAZARD ..... N

PRODUCT ABOVE 0.1%, THE OSHA STANDARD FOR BENZENE IS APPLICABLE TO WORK LOCATIONS UPSTREAM OF FINAL DISCHARGE FROM TERMINALS. CONSULT 29CFR1910.1028 FOR DETAILS. PROLONGED AND REPEATED EXCESSIVE EXPOSURES TO BENZENE CAN RESULT IN BLOOD DISORDERS RANGING FROM ANEMIA TO LEUKEMIA. RECOMMEND THAT EXPOSURES TO BENZENE BE KEPT BELOW 1.0 PPM FOR 8-HOURS; 5.0 PPM FOR 15-MIN. NORMAL SERVICE STATION OPERATIONS ARE BELOW THESE VALUES. FOR USE AS A MOTOR FUEL ONLY. DO NOT USE FOR ANY OTHER PURPOSE.



**MSDS**  
**Fire Extinguishers**

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**\*\*\* IDENTIFICATION \*\*\***

**MSDS RECORD NUMBER : 503384**  
**PRODUCT NAME(S): General Triplex Dry**  
**Chemical**

**Flammable Limits NA**  
**LEL NA**  
**UEL NA**  
**Extinguishing Media NA - Fire Extinguishing agent**

**\*\*\* MATERIAL SAFETY DATA \*\*\***

**Material Safety Data Sheet U.S. Department of Labor May be used to comply with Occupational Safety and Health OSHA's Hazard Communication Administration Standard, 29 CFR 1910.1200. (Non-Mandatory Form) Standard must be consulted for Form Approved specific requirements. OMB No. 1218-0072**

**Special Fire Fighting Procedures**  
**Unusual Fire and Explosion Hazards**

**Section II - Hazardous Ingredients/Identity Information**

**Hazardous Components OSHA PEL ACGIH TLV Other Limits (Specific Chemical Identity; Recommended % (optional) Common Name(s))**

**Section V - Reactivity Data**  
**Stability Unstable [ ] Conditions to Avoid Stable [X]**

**Not Applicable - Dry Chemical Fire Extinguishing Agent - Monoammonium Phosphate Base Contains No Hazardous Ingredients**

**Incompatibility (Materials to Avoid)**  
**Do not mix with bicarbonate base fire extinguishing agents.**

**Section III - Physical/Chemical Characteristics**

**Boiling Point NA**  
**Specific Gravity (H<sub>2</sub>O = 1) 1.8**  
**Vapor Pressure (mm Hg.) NA**  
**Melting Point NA**  
**Vapor Density (AIR = 1) NA**  
**Evaporation Rate NA (Butyl Acetate = 1)**  
**Solubility in Water**  
**Water repellent. 94% soluble.**  
**Appearance and Odor Fine yellow Powder**

**Hazardous Decomposition or Byproducts**  
**Decomposes to ammonia and phosphoric acid at high temperature.**

**Hazardous Conditions to Avoid**  
**May Occur [ ]**  
**Polymerization Will Not Occur [X]**

**Section VI - Health Hazard Data**

**Route(s) of Entry: NA**  
**Inhalation? Skin? Ingestion?**  
**NA NA NA**

**Section IV - Fire and Explosion Hazard Data**  
**Flash Point (Method Used) NA**

**Health Hazards (Acute and Chronic) NA**

**Carcinogenicity: NA NTP? IARC Monographs? OSHA Regulated?**

**Signs and Symptoms of Exposure NA**

**Medical Conditions Generally Aggravated by Exposure NA**

**Emergency and First Aid Procedures Wash from eyes with warm water.**

**Section VII - Precautions for Safe Handling**

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**MSDS**  
**Fire Extinguishers**

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**and Use**

Clean up in normal manner. Use vacuum to avoid causing dust.

**Waste Disposal Method**

Dispose of in normal manner. Use closed container to prevent dust.

**Precautions to Be Taken in Handling and Storing**

Protect from moisture

**Other Precautions**

**Section VIII - Control Measures**

**Respiratory Protection (Specify Type)**

Use particle mask, 3M 8500 Non-Toxic, when handling

**Ventilation**

<b>Local Exhaust</b>	<b>Special</b>
	Use to remove dust
<b>Mechanical (General)</b>	<b>Other</b>

<b>Protective Gloves</b>	<b>Not needed</b>	<b>Eye</b>
<b>Protection</b>	<b>Not needed</b>	

**Other Protective Clothing or Equipment**  
Not needed.

**Work/Hygienic Practices**

After handling, wash exposed skin with warm water and soap.

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**Steps to Be Taken in Case Material is Released or Spilled**



**MSDS**  
**Fire Extinguishers**

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\*\*\*\*\*  
\* M S D S \*  
\* \*  
\* Canadian Centre for Occupational  
Health and Safety \*  
\*\*\*\*\* Issue : 94-4  
(November, 1994) \*

\*\*\* IDENTIFICATION \*\*\*

MSDS RECORD NUMBER : 503383  
PRODUCT NAME(S) : General  
"Quick-Aid" Dry Chemical  
DATE OF MSDS : 1986-05-06

\*\*\* MANUFACTURER  
INFORMATION \*\*\*

MANUFACTURER : General Fire  
Extinguisher Corporation  
ADDRESS : 1685 Shermer Road  
Northbrook Illinois  
U.S.A. 60062  
Telephone: 312-272-7500

(Information)

EMERGENCY TELEPHONE NO. :  
312-729-8800

\*\*\* MATERIAL SAFETY  
DATA \*\*\*

Material Safety Data Sheet U.S.  
Department of Labor  
May be used to comply with  
Occupational Safety and Health  
OSHA's Hazard Communication  
Administration  
Standard, 29 CFR 1910.1200.  
(Non-Mandatory Form)  
Standard must be consulted for Form  
Approved  
specific requirements. OMB No.  
1218-0072

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**IDENTITY (As Used on Label and List)**  
Note: Blank spaces are not permitted.  
General "Quick-Aid" Dry Chemical If  
any item is not applicable, or no  
information is  
available, the space  
must be marked to  
indicate that.

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Section I  
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Date Prepared May 6, 1986  
Signature of Preparer (optional) William R.  
Warnock

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Section II - Hazardous Ingredients/Identity  
Information  
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Hazardous Components OSHA PEL  
ACGIH TLV Other Limits  
(Specific Chemical Identity;  
Recommended % (optional)  
Common Name(s))

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Not Applicable - Dry Chemical Fire  
Extinguishing Agent - Sodium Bicarbonate  
Base.  
Contains no hazardous ingredients.

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Section III - Physical/Chemical  
Characteristics  
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**MSDS**  
**Fire Extinguishers**

**Boiling Point** NA      **Specific Gravity**  
(H<sub>2</sub>O = 1) 2.16  
**Vapor Density (AIR = 1)** NA      **Evaporation**  
**Rate** NA  
**Solubility in Water** (Butyl Acetate = 1)  
Water repellent. 98%  
soluble  
**Appearance and Odor** Fine white powder

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**Section IV - Fire and Explosion Hazard Data**

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**Flash Point (Method Used)** NA  
**Flammable Limits** LEL UEL  
NA NA  
**Extinguishing Media** NA - Fire  
**Extinguishing agent**  
**Special Fire Fighting Procedures** NA  
**Unusual Fire and Explosion Hazards** NA

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**Section V - Reactivity Data**

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**Stability** Unstable [ ]      **Conditions to**  
**Avoid**  
Stable [X]  
**Incompatibility (Materials to Avoid)**  
Do not mix with ammonium phosphate base  
fire extinguishing agents.  
**Hazardous Decomposition or Byproducts**  
Decomposes to sodium carbonate, carbon  
dioxide and water at high temperatures.  
**Hazardous** May Occur [ ]  
**Conditions to Avoid**  
**Polymerization** Will Not Occur [X]

**Vapor Pressure (mm Hg.)** NA      **Melting**  
**Point** NA

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**Section VI - Health Hazard Data**

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**Route(s) of Entry:**      **Inhalation?**      **Skin?**  
**Ingestion?**  
NA      NA      NA  
NA

**Health Hazards (Acute and Chronic)** NA

**Carcinogenicity:** NA      **NTP?**      **IARC**  
**Monographs?**      **OSHA Regulated?**

**Signs and Symptoms of Exposure** NA

**Medical Conditions Generally Aggravated by**  
**Exposure** NA

**Emergency and First Aid Procedures** Wash  
from eyes with warm water.

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**Section VII - Precautions for Safe Handling**  
**and Use**

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**Steps to Be Taken in Case Material is**  
**Released or Spilled**  
Clean up in normal manner. Use vacuum to  
avoid causing dust.

**Waste Disposal Method**  
Dispose of in normal manner. Use closed  
container to prevent dust.

**Precautions to Be Taken in Handling and**  
**Storing**  
Protect from moisture.

**Other Precautions**



**MSDS**  
**Fire Extinguishers**

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**Section VIII - Control Measures**

**Use particle mask, 3M 8500 Non-Toxic, when handling**

<b>Ventilation</b>	<b>Local Exhaust</b>	<b>Special</b>
	<b>Use to remove dust</b>	
	<b>Mechanical (General)</b>	<b>Other</b>

<b>Protective Gloves</b>	<b>Not needed</b>	<b>Eye</b>
<b>Protection</b>	<b>Not needed</b>	

**Other Protective Clothing or Equipment**

-----  
-----  
**Respiratory Protection (Specify Type)**

**Not needed.**

**Work/Hygienic Practices**

**After handling, wash exposed skin with warm water and soap.**

---



**MSDS**  
**Fire Extinguishers**

\*\*\*\*\*  
\*\*\*\*\*  
\* M S D S \*  
\* \*  
\* Canadian Centre for Occupational  
Health and Safety \*  
\*\*\*\*\* Issue : 94-4  
(November, 1994) \*

\*\*\* IDENTIFICATION \*\*\*

MSDS RECORD NUMBER : 503382  
PRODUCT NAME(S) : General Purple K  
Dry Chemical  
DATE OF MSDS : 1986-05-06

\*\*\* MANUFACTURER  
INFORMATION \*\*\*

MANUFACTURER : General Fire  
Extinguisher Corporation  
ADDRESS : 1685 Shermer Road  
Northbrook Illinois  
U.S.A. 60062  
Telephone: 312-272-7500

(Information)

EMERGENCY TELEPHONE NO. :  
312-729-8800

\*\*\* MATERIAL SAFETY  
DATA \*\*\*

Material Safety Data Sheet U.S.  
Department of Labor  
May be used to comply with  
Occupational Safety and Health  
OSHA's Hazard Communication  
Administration  
Standard, 29 CFR 1910.1200.  
(Non-Mandatory Form)  
Standard must be consulted for Form  
Approved  
specific requirements. OMB No.  
1218-0072

-----  
**IDENTITY (As Used on Label and List)**  
Note: Blank spaces are not permitted.  
General Purple K Dry Chemical If any  
item is not applicable, or no  
information is  
available, the space  
must be marked to  
indicate that.

-----  
Section I  
-----

Date Prepared May 6, 1986  
Signature of Preparer (optional) William R.  
Warnock

-----  
Section II - Hazardous Ingredients/Identity  
Information  
-----

-----  
Hazardous Components OSHA PEL  
ACGIH TLV Other Limits  
(Specific Chemical Identity;  
Recommended % (optional)  
Common Name(s))  
-----

-----  
Not Applicable - Dry Chemical Fire  
Extinguishing Agent - Potassium Bicarbonate  
Base  
Contains no hazardous ingredients.  
-----

-----  
Section III - Physical/Chemical  
Characteristics  
-----



**MSDS**  
**Fire Extinguishers**

**Boiling Point** (H<sub>2</sub>O = 1) NA **Specific Gravity** 2.17  
**Vapor Density** (AIR = 1) NA **Evaporation Rate** NA  
 (Butyl Acetate = 1)  
**Solubility in Water** Water repellent. 94% soluble  
**Appearance and Odor** Fine purple powder

**Section IV - Fire and Explosion Hazard Data**

**Flash Point** (Method Used) NA  
**Flammable Limits** LEL UEL NA  
 NA NA  
**Extinguishing Media** NA - Fire extinguishing agent  
**Special Fire Fighting Procedures** NA  
**Unusual Fire and Explosion Hazards** NA

**Section V - Reactivity Data**

**Stability** Unstable [ ] **Conditions to Avoid**  
 Stable [X]

**Incompatibility (Materials to Avoid)**  
 Do not mix with ammonium phosphate base fire extinguishing agents.

**Hazardous Decomposition or Byproducts**  
 Decomposes to potassium carbonate, carbon dioxide and water at high temperatures.

**Hazardous Conditions to Avoid** May Occur [ ]  
**Polymerization** Will Not Occur [X]

**Vapor Pressure** (mm Hg.) NA **Melting Point** NA

**Section VI - Health Hazard Data**

**Route(s) of Entry:** **Inhalation?** **Skin?**  
**Ingestion?**  
 NA NA NA  
 NA

**Health Hazards (Acute and Chronic)** NA

**Carcinogenicity:** NA **NTP?** **IARC Monographs?** **OSHA Regulated?**

**Signs and Symptoms of Exposure** NA

**Medical Conditions Generally Aggravated by Exposure** NA

**Emergency and First Aid Procedures** Wash from eyes with warm water.

**Section VII - Precautions for Safe Handling and Use**

**Steps to Be Taken in Case Material is Released or Spilled**  
 Clean up in normal manner. Use vacuum to avoid causing dust.

**Waste Disposal Method**  
 Dispose of in normal manner. Use closed container to prevent dust.

**Precautions to Be Taken in Handling and Storing**  
 Protect from moisture.

**Other Precautions**



**MSDS**  
**Fire Extinguishers**

---

-----  
-----  
**Section VIII - Control Measures**

-----  
-----  
**Respiratory Protection (Specify Type)**

Use particle mask 3M 8506 Non-Toxic, when handling.

<b>Ventilation</b>	<b>Local Exhaust</b>	<b>Special</b>
	Use to remove dust.	
	<b>Mechanical (General)</b>	<b>Other</b>

<b>Protective Gloves</b>	<b>Not needed</b>	<b>Eye</b>
<b>Protection</b>	<b>Not needed</b>	

**Other Protective Clothing or Equipment**  
Not needed.

**Work/Hygienic Practices**  
After handling, wash exposed skin with warm water and soap.

---



**MSDS**  
**Fire Extinguishers**

\*\*\*\*\*  
\*\*\*\*\*  
\* MSDS \*  
\* \*  
\* Canadian Centre for Occupational  
Health and Safety \*  
\*\*\*\*\* Issue : 94-4  
(November, 1994) \*

\*\*\* IDENTIFICATION \*\*\*

MSDS RECORD NUMBER : 500586  
PRODUCT NAME(S) : General LS-61  
Anti Freeze Charge  
DATE OF MSDS : 1990-09

\*\*\* MANUFACTURER  
INFORMATION \*\*\*

MANUFACTURER : General Fire  
Extinguisher Corporation  
ADDRESS : 1685 Shermer Road  
Northbrook Illinois  
U.S.A. 60062  
Telephone: 312-272-7500

(Information)

EMERGENCY TELEPHONE NO. :  
312-729-8800

\*\*\* MATERIAL SAFETY  
DATA \*\*\*

Material Safety Data Sheet U.S.  
Department of Labor  
May be used to comply with  
Occupational Safety and Health  
OSHA's Hazard Communication Standard,  
Administration  
29 CFR 1910.1200. Standard must be  
(Non-Mandatory Form)  
consulted for specific requirements. Form  
Approved

OMB No. 1218-0072

**IDENTITY (As Used on Label and List)**  
**General LS-61 Anti Freeze Charge**

Note: Blank spaces are not permitted. If any  
item is not applicable or no  
information is available, the space must be  
marked to indicate that.

Section I

Date Prepared May 6, 1986  
Septembre 1990  
Signature of Preparer (optional) William  
R. Warnock

Section II - Hazardous Ingredients/Identity  
Information

Hazardous Components  
(Specific Chemical  
Identity; Common Name(s)) OSHA  
PEL ACGIH TLV % (optional)

Anti-Freeze Charge for Pressurized Water  
Anti-gel charge d'eau pressurize

Fire Extinguishers Extincteurs d'incendie

Potassium Carbonate Carbone potasse Not  
Specified Non specifie >50%  
Other Limits Recommended:

Potassium Acetate Acetate potasse Not  
Established Non etabli <50%  
Other Limits Recommended:

Section III - Physical/Chemical



**MSDS**  
**Fire Extinguishers**

**Characteristics**

-----  
-----  
**Boiling Point** Point d'ebullition NA  
**Vapor Pressure (mm Hg)** pressure vapeur NA  
**Vapor Density (AIR = 1)** densite vapeur NA  
**Specific Gravity (H20 = 1)** 2.0  
 Gravite specifique  
**Melting Point** point de fonte NA  
**Evaporation Rate** taux d'evaporation NA  
 (Butyl Acetate = 1)  
**Solubility in Water** 100%  
 solubilite d'eau  
**Appearance and Odor**  
**Off-White granular powder**  
 apparence & odeur poudre  
 granule blanc casse

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-----  
**Section IV - Fire and Explosion Hazard Data**  
 schema feu & explosion hazard

-----  
-----  
**Flash Point (Method Used)** NA  
 point d'etincelles NA  
  
**Flammable Limits** limite flammable  
**LEL UEL**  
 NA NA NA

**Extinguishing Media** NA - Fire extinguisher  
 charge  
 point d'extinction charge d'extincteur  
 d'incendie

**Special Fire Fighting Procedures**  
 Procedure speciale pour combattre l'incendie

**Unusual Fire and Explosion Hazards**  
 Hazard feu & explosion peu commun

-----  
**Section V- Reactivity Data**

-----  
-----  
**Stability** Unstable [ ] Conditions to  
 Avoid  
**Stabilite** instable Conditions a  
 eviter  
  
 Stable [X]  
 Stable

**Incompatibility (Materials to Avoid)** NA  
 Incompatibilite materiel a eviter

**Hazardous Decomposition or Byproducts**  
 NA  
 Decomposition hazardeuse sous-produit

**Hazardous Polymerization** May Occur [ ]  
 Conditions to Avoid  
 polymerization a survenir  
 Conditions a eviter  
 Will Not Occur [X]  
 ne surviendra pas.

-----  
-----  
**Section VI - Health Hazard Data** Schema  
 hazard sante

-----  
-----  
**Route(s) of Entry** Inhalation? Skin?  
**Ingestion?**  
 NA NA NA  
 NA

**Health Hazards (Acute and Chronic)**  
 May cause irritation of the skin and eyes.  
 Peut causer irritation de la peau et des  
 yeux.

**Carcinogenicity:** NA NTP? IARC  
**Monographs?** OSHA Regulated?  
 cancerigene N/A



**MSDS**  
**Fire Extinguishers**

---

**Signs and Symptoms of Exposure**      **NA**  
**Signes et symptomes a l'exposition**

**Medical Conditions Generally Aggravated by Exposure**      **NA**  
**Conditions medical aggrave par exposition**

**Emergency and First Aid Procedures**  
**Alkaline, Wash from eyes with large volume of warm water.**  
**Laver les yeux avec une large quantite d'eau tiede**  
**Consult doctor. Wash from skin with warm water.**  
**Consulter un medecin. Laver la peau avec eau tiede**

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-----  
**Section VII - Precautions for Safe Handling and Use**

**Precaution pour utilisation secure**

-----  
-----  
**Steps to Be Taken in Case Material is Released or Spilled**  
**Sweep up and dispose in normal manner.**  
**Flush spill area with water**  
**balayer de maniere normale. Laver la piece avec de l'eau**

**Waste Disposal Method**      **Methode pour dechets**  
**Dispose in normal manner.**      **Disposer de maniere normale**

**Precautions to Be Taken in Handling and Storing**      **Protect from moisture.**  
**precaution a prendre pour utilisation**  
**proteger de la moissisure**

**Other Precautions**      **Autres precautions**

-----  
-----  
**Section VIII - Control Measures**      **Mesures controle**

-----  
-----  
**Respiratory Protection (Specify Type)**  
**Not required.**      **Protection respiratoire non requise**

**Ventilation**      **Local Exhaust**      **Special Ventilation**      **Mechanical (General)**      **Other**

**Protective Gloves**  
**Wear rubber gloves when preparing solution.**

**Eye Protection**  
**Wear goggles or glass with side shields when preparing solution.**

**Other Protective Clothing or Equipment**  
**Wear long sleeves when preparing solution.**

**Work/Hygienic Practices**  
**After handling, wash exposed skin thoroughly with warm water.**

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# MATERIAL SAFETY DATA SHEET

## DETONATING CORD

DATE SEPTEMBER 1998 MSDS NO. C-1 PAGE 2 OF 2

### SECTION VI REACTIVITY DATA

Issued by the Safety and Compliance Dept.

**STABILITY:** Stable under normal conditions. May explode when subjected to fire or shock.  
**INCOMPATIBILITY (MATERIALS TO AVOID):** Avoid contact with strong acids or alkalis.  
**HAZARDOUS DECOMPOSITION PRODUCTS:** Gaseous Nitrogen Oxides and Carbon Oxides.  
**HAZARDOUS POLYMERIZATION WILL NOT OCCUR.**

### SECTION VII SPILL OR LEAK PROCEDURES

**STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:** Sweep up and dispose of all spilled material immediately. Do not permit smoking or open flames near spill site.

**WASTE DISPOSAL METHOD:** Dispose of under direct supervision of a qualified person according to local, state and federal regulations. Call Austin Powder for recommendations and assistance. This material may become a hazardous waste under certain conditions and must be collected, labeled and disposed of per state and federal hazardous waste regulations.

**TRANSPORTATION EMERGENCIES** involving spills, leaks, fires or exposures in the United States:  
**CALL CHEMTREC:** 1-800-424-9300. For emergency calls originating outside the U. S. dial the U. S. access number followed by: 1-703-527-3887. All calls are recorded.

### SECTION VIII SPECIAL PROTECTION INFORMATION:

<b>RESPIRATORY PROTECTION:</b>	Not required under normal conditions.
<b>VENTILATION:</b>	Not required under normal conditions.
<b>PROTECTIVE GLOVES:</b>	Not required except to prevent abrasive injuries.
<b>EYE PROTECTION:</b>	Not required under normal conditions.

### SECTION IX SPECIAL PRECAUTIONS

COMPLY WITH "ALWAYS AND NEVER" AS ADOPTED BY THE INSTITUTE OF MAKERS OF EXPLOSIVES. TRANSPORTATION, STORAGE AND USE MUST COMPLY WITH OSHA SAFETY AND HEALTH STANDARDS 29CFR1910.109, APPLICABLE MSHA REGULATIONS, THE DOT AND HAZARDOUS MATERIALS REGULATIONS BATF REQUIREMENTS AND STATE AND LOCAL TRANSPORTATION, STORAGE AND USE REGULATIONS AND ORDINANCES.

DOT or IMDG proper shipping description: Cord, Detonating, Flexible, 1.1D, UN0065, PG II

May be offered for transportation domestically and transported as Cord, Detonating (UN 0289), Division 1.4 compatibility group D (1.4D) Explosives, if the explosive content does not exceed 100 grains per linear foot and the gross weight of all packages of detonating cord does not exceed (45 KG) 99 pounds per vehicle. See 49 CFR 173.63

The maximum recommended temperature for detonating cord is 160°F (71°C).

None of the components are listed in the 1987 IARC Monographs, Group 1, 2A or 2B as known, probable, or possible carcinogens, nor are they listed in the NTP annual report on carcinogens.

Composition C-4

TYPE: Non-Initiating

USE: Plastic Demolition Explosive

CLASSIFICATION: MILITARY 1.1 SCG D

DOT: Class A

PHYSICAL

DENSITY: 1.59 gm/cc  
COLOR: Light Brown  
MELTING POINT:  
SOLUBILITY: Soluble in Acetone

CHEMICAL

MOLECULAR WEIGHT:  
FORMULA: RDX 91%  
Plasticizer 9%

SENSITIVITY AND OTHER CHARACTERISTICS

IMPACT SENSITIVITY (2 Kg. Weight)

Picatinny Arsenal - 19 in.  
Bureau of Mines - 100+ cm

FRICITION PENDULUM TEST

Steel Shoe - No Reaction  
Fibre Shoe - No Reaction

FRICITION (8 Ft/Sec.)

RIFLE BULLET IMPACT TEST  
20% Burns

STATIC SENSITIVITY:

EXPLOSION TEMPERATURE (5 Sec) 290°C

INITIATION: (Lead Azide 0.20 gm.  
Tetryl 0.10 gm.)

STABILITY

International Heat Test:  
(100°C) 0.13%  
Vacuum Stability:  
(100°C) 0.26 cc.

BRISANCE (Sand Test in gm.): 55.7 gm.

DETONATION VELOCITY: 8040 m/sec.

SPECIAL HEALTH HAZARDS: Can be absorbed by ingestion and inhalation, but does not penetrate the skin. Can cause headache, insomnia, dizziness, restlessness, and convulsions resulting from central nervous system stimulation. The convulsions resemble grand mal or epileptic seizures. It does not exhibit pharmacological effects similar to nitrates or nitrites. No effects from skin or eye contacts have been reported. Ventilation should be provided to reduce the inhalation hazard. Employees should be cautioned of the effects from accidental or intentional ingestion. Oxides of nitrogen and carbon will be present in the combustion products. Lung irritation may be produced either promptly or delayed a few hours after exposure.

SHIPPING AND HANDLING:





# MATERIAL SAFETY DATA SHEET

## ELECTRIC DETONATORS NON ELECTRIC DETONATORS

DATE AUGUST 1998 MSDS NO. ED-1 PAGE 2 OF 2

### SECTION VI REACTIVITY DATA

Issued by the Safety and Compliance Dept.

**STABILITY:** May explode when subjected to flame, heat, impact, friction, electric currents, electrostatic or radio frequency energy. Avoid static charge build up. Keep lead wires shunted until wiring into circuit.

**INCOMPATIBILITY (MATERIALS TO AVOID):** Avoid contact with acids or alkalis.

**HAZARDOUS DECOMPOSITION PRODUCTS:** Gaseous Nitrogen Oxides, Carbon Oxides, and lead fumes.

**HAZARDOUS POLYMERIZATION WILL NOT OCCUR.**

### SECTION VII SPILL OR LEAK PROCEDURES

**STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:** Pick up containers or units by hand. Avoid conditions affecting stability. DO NOT use damaged detonators.

**WASTE DISPOSAL METHOD:** Dispose of under direct supervision of a qualified person according to local, state and federal regulations. Call Austin Powder for recommendations and assistance. This material may become a hazardous waste under certain conditions and must be collected, labeled and disposed of per state and federal hazardous waste regulations.

**TRANSPORTATION EMERGENCIES** involving spills, leaks, fires or exposures in the United States:  
**CALL CHEMTREC:** 1-800-424-9300. For emergency calls originating outside the U. S. dial the U. S. access number followed by: 1-703-527-3887. All calls are recorded.

### SECTION VIII SPECIAL PROTECTION INFORMATION:

**RESPIRATORY PROTECTION:** Avoid breathing fumes from detonation.

**VENTILATION:** Not required.

**PROTECTIVE GLOVES:** Not required.

**EYE PROTECTION:** Not required.

### SECTION IX SPECIAL PRECAUTIONS

COMPLY WITH "ALWAYS AND NEVER" AS ADOPTED BY THE INSTITUTE OF MAKERS OF EXPLOSIVES. TRANSPORTATION, STORAGE AND USE MUST COMPLY WITH OSHA SAFETY AND HEALTH STANDARDS 29CFR1910.109, APPLICABLE MSHA REGULATIONS, THE DOT AND HAZARDOUS MATERIALS REGULATIONS BATF REQUIREMENTS AND STATE AND LOCAL TRANSPORTATION, STORAGE AND USE REGULATIONS AND ORDINANCES.

THESE DETONATORS MAY BE SHIPPED UNDER ONE OF THE FOLLOWING DOT CLASSIFICATIONS:

DOT or IMDG proper shipping description:

Detonators, Electric, 1.4B, UN0255, PGII

Detonators, Electric, 1.1B, UN0030, PGII

Detonator Assemblies, Non-Electric, 1.1B, UN0360, PGII

Detonator Assemblies, Non-Electric, 1.4B, UN0361, PGII

Articles, explosive, n.o.s. 1.4S, UN0349, PGII

Consult IME Safety Library Publication No. 20, SAFETY GUIDE FOR THE PREVENTION OF RADIO FREQUENCY RADIATION HAZARDS IN THE USE OF ELECTRIC BLASTING CAPS, and Publication No. 22, RECOMMENDATIONS FOR THE SAFE TRANSPORTATION OF DETONATORS IN A VEHICLE WITH CERTAIN OTHER EXPLOSIVE MATERIALS.

ATTACHMENT 5

RESUMES



**WAIKOLOA MANEUVER AREA WORK PLAN****KAMUELA, ISLAND OF HAWAII**

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**ROBERT D. CROWNOVER****CORPORATE HEALTH & QUALITY MANAGER**

Date Completed Basic EOD School: August 1978

Never been removed from an EOD/UXO assignment for personnel reliability.

---

## EOD/UXO Assignments:

- Aug 78 - Apr 80 EOD Technician, 45th EOD, Ft. Polk, LA. Team member who assists in locating, identifying, removal & destruction of munitions. Member of range clearance team. Assisted in classroom & practical instruction.
- Apr 80 - Jun 83 EOD Technician, 72nd EOD, Bremerhaven, Germany. Team member who assists in determining and implementing render safe & disposal procedures. Range safety NCO. Assisted in training EOD and non-EOD personnel.
- Jun 83 - Sep 87 EOD Supervisor, 60th EOD, Ft. Dix, NJ. Assumed command of an EOD Team. Determined render safe and disposal procedures. Performed administrative functions. Supervised other EOD personnel. Conducted range operations.
- Sep 87 - May 90 EOD Instructor, EOD Trg. Det #1, Eglin AFB, Florida. Taught courses in ordnance recovery, protection of personnel and property safety, ORD. ID, and access and recovery. Testing of applied instructions. Drafting, finalizing and implementing testing criteria.
- May 90 - Sep 90 EOD Supervisor, 52nd EOD, Pine Bluff, AR. Team leader during EOD operations. Range Safety NCO. Conducted training in EOD related matters. Conducted range operations. Performed administrative functions.
- Sep 90 - May 91 EOD Supervisor, 16th EOD, Camp Darby, IT. Team leader during EOD operations. Assist in determining and implementing policy. Range NCO. Safety NCO. Training of other EOD & non-EOD personnel. Regulated administrative functions.
- May 91 - Dec 91 EOD Supervisor, 137th EOD, Ft. Sam, Houston, TX. Assumed command of an EOD team. Conducted range safety classes. Conducted training in EOD related matters. Determined render safe and disposal procedures Security functions.
- Mar 93 - Sep 94 UXO Supervisor, CMSI, Kuwait. Team member on minefield team. Conducted sweep, demolition and bunker operations. Field supervisor for 213 Third Country Nationals (TCN), 4 EOD technicians. Conducted training for TCN. Supervised disposal operations.
- Aug 95 – Jun 96 UXO Specialist, CMS Environmental, Inc., Fort Ord, CA. UXO Team member of a BRAC clearance and removal action.
-

**WAIKOLOA MANEUVER AREA WORK PLAN****KAMUELA, ISLAND OF HAWAII**

---

Jun 96 – Sep 96	UXO Supervisor, CMS Environmental, Inc., Ft. Ord, CA. Sampling and removal of OEW.
Sep 96 – Jul 98	Site Safety Officer, CMS Environmental, Inc., Ft. Ord, CA. Responsible for the overall safety of the project personnel and compliance with the Site Safety and Health Plan.
Jul 98 – Nov 99	Site Safety Officer, USA Environmental, Inc., Ft. Ord, CA. Responsible for the overall safety of the project personnel and compliance with the Site Safety and Health Plan.
Nov 99 – Present	Corporate Safety & Health Manager/Quality Control Manager, USA Environmental, Inc., Tampa, FL. Responsible for the development and implementation of USA's Safety and QC programs and plans. Performs project site inspections and audits to ensure compliance with requirements and standards. Reviews draft and final work plans, reports, and associated documents for accuracy, completeness, and content. Interfaces with agencies on safety, health, and/or quality issues at the corporate or job site levels.

**Education** B.S., Chemical Engineering & Materials Engineering, The University of Connecticut, May 1996

**Registration** Registered Professional Engineer (State of Maryland, No. 29261)

**Professional Training**

- 24-Hour Hazardous Waste Operations and Emergency Response/8-Hour Annual Refreshers
- 8-Hour Hazardous Waste Operations and Emergency Response Supervisor Training
- American Red Cross CPR/First Aid Certification
- RCRA Hazardous Waste Management Training
- ISO14001 Internal Auditor Training

**Professional Experience**

**09/2003 – Present USA Environmental, Incorporated – Tampa, Florida**

As Environmental Engineer, Mr. Synakorn provides project management, technical and analytical project support, and report writing support to various environmental projects under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA), supporting Department of Defense initiatives at unexploded ordnance and chemical warfare materiel sites. Responsibilities include technical guidance, quality assurance, project coordination, and cost management.

- Serves as the Project Manager for the Phase III Ordnance and Explosives Engineering Evaluation/Cost Analysis of the former Waikoloa Maneuver Area.
- Serves as the Professional Engineer-In-Charge for various projects, providing engineering guidance, technical writing support, and quality review of project deliverables.

**10/2001 – 08/2003 General Physics Corporation – Edgewood, Maryland**

As Sr. Environmental Engineer, Mr. Synakorn provides technical, analytical, and report writing support to various projects in the CERCLA remediation process, in support of the U.S. Army Garrison Aberdeen Proving Ground's Installation Restoration Program (IRP).

- Served as the Task Manager for projects within the former Nike Missile Battery, specifically, Long-Term Monitoring of the Former Nike Missile Battery Site, Operations and Maintenance of the Nike Groundwater Treatment System, and Operations and Maintenance of the Nike Southwest Landfill.
- Served as the Field Operations Manager for the Canal Creek and Westwood Area Northern Boundary Surface UXO Survey.
- Developed the Remedial Design Plan for the Remedial Action at the Cluster 5 Concrete Slab Test Site, consisting of the technical design approach, health and safety, quality control, and erosion control provisions

- Developed the Project Plan for the Maxwell Point Offshore Investigation, consisting of the technical approach and health and safety provisions
- Developed Health and Safety Plan for the Removal Action at the Cluster 2 Grenade/ Incendiary Disposal/Burn Pit D and for site investigations in the Other Edgewood Areas
- Analyzed monitoring data and prepared the long-term monitoring annual report for the Old Bush River Road Dump and Watson Creek operable units

**03/1998 – 09/2001 King Industries, Incorporated – Norwalk, Connecticut**

As Environmental Engineer, Mr. Synakorn ensured plant-wide environmental compliance to all state and federal permits and regulations, tracking waste generation, ensuring proper waste management, identifying waste minimization opportunities, and monitoring discharge and emissions.

- Designed carbon treatment system for process wastewater to reduce downtime and man hours required in processing of spent carbon
- Characterized waste streams and developed waste minimization plan which include recycling, reclamation, and reduction
- Re-issuance of wastewater discharge permit through the state DEP
- Monitored plant processes for compliance with state permits and federal regulations
- Conducted ISO14001 audits to confirm environmental system compliance
- Monthly reporting of wastewater discharges and analytical results to the state DEP
- Quarterly fugitive emissions leak testing in accordance with 40CFR Part 265 Subpart BB & CC, and RCSA 22a-174-20(x)

As Production Engineer, Mr. Synakorn assumed the role of plant supervisor during the 2<sup>nd</sup> shift, communicating production goals, ensuring safe work practices, identifying batch and process inefficiencies, and monitoring product and process quality.

- Supervised activities of Production operators, drummers, and off-shift mechanics
- Scheduled batch production to meet weekly production plan
- Monitored processes for compliance with company quality standards
- Reviewed batch results and updated batch production sheets for process improvements
- Conducted ISO9001 audit to confirm quality system compliance
- Initiated actions to prevent product, process and quality system non-conformities in accordance with ISO 9001
- Approved required overtime to meet production demand
- Assisted in Operator training

---

**APPENDIX E ENVIRONMENTAL SAMPLING AND ANALYSIS PLAN**

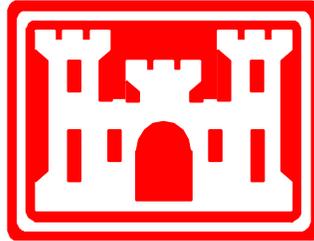
Environmental sampling and analysis is not required for this project.



**DRAFT**

**ENGINEERING EVALUATION AND COST ANALYSIS (EE/CA)  
GEOPHYSICAL PROVE-OUT LETTER REPORT**

**FOR THE OE ENGINEERING EVALUATION AND COST ANALYSIS (EE/CA) WAIKOLOA  
MANEUVER AREA - PHASE III EE/CA, KAMUELA, ISLAND OF HAWAII, HAWAII**



**15 OCTOBER 2003**

Prepared for

**U.S. ARMY ENGINEERING SUPPORT CENTER (CEHNC-OE-DC)  
4820 UNIVERSITY SQUARE  
HUNTSVILLE, ALABAMA 35816**

**U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT (CEPOH-PM)  
BUILDING 230  
FORT SHAFTER, HI 96858-5440**

**CONTRACT NO. DACA87-00-D-0036  
TASK ORDER 00016**

Prepared by  
**USA Environmental, Inc.  
5802 Benjamin Center Drive, Suite 101  
Tampa, Florida 33634**

---

USA Environmental, Inc. Project Manager

---

Date



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## DRAFT GPO LETTER REPORT

### F.1 INTRODUCTION

USA Environmental, Inc. (USA) performed the geophysical prove-out (GPO) on the Waikoloa GPO plot established by the U. S. Engineering Support Center, Huntsville (USAESCH). This plot consisted of three adjacent 100' x 100' grids for a total area roughly 100' x 300'. The USAESCH seeded one of the grids (designated as the known grid in this report) and provided the ground truth for the seed items. The USAESCH seeded a second grid (designated as the unknown grid in this report) as a blind test grid. The third grid was the Government/Contractors' grid, where both the Government and contractors are able to seed additional items, following ordnance and explosives (OE) avoidance procedures. This grid is designated as the contractors' grid in this report.

USA also surveyed portions of the Waimea GPO. This plot also consisted of three adjacent 100' x 100' grids for a total area roughly 100' x 300'. The same grid designations as the Waikoloa GPO were used. The Waimea known grid was surveyed with the grid survey method. A transect survey was performed along two 300' lines through the center of all three grids. A Meandering Path survey was performed over the unknown grid.

The location and site maps for these areas are provided in section B.11 of this report.

USA deployed a team of four personnel for this GPO. The project team included:

- The Project Manager, Mr. Doug Ralston, also a Senior Unexploded Ordnance (UXO) Supervisor,
- The Project Engineer, Mr. David Synakorn
- The Site Geophysicist, Ms. Karen Lemley (NAEVA)
- UXO Tech I, Mr. Adam Chionchio

For this GPO, USA deployed the following equipment:

- A Geonics EM61MK2 with the 1.0 x 0.5 meter coil and Allegro 4000 data logger
- A Trimble 4700 Real Time Kinematic Differential Global Positioning System (RTK DGPS)
- A laptop computer with:
  - Geonics' sensor software for downloading and exporting data
  - Geosoft's software for initial processing and field analysis

The GPO team deployed the EM61MK2 in stretcher mode for all survey work and in wheeled mode during anomaly reacquisition. The GPO team configured the EM61MK2 data logging to record all four bottom coil time gate data at a 10 Hz rate.

The project team positioned the base Real Time Kinematic (RTK) Differential Global Positioning System (DGPS) at the Power Line survey control point for all work at the Waikoloa GPO. The project team used the NE corner of the Waimea GPO as the base RTK DGPS for all work at the Waimea GPO. The rover RTK DGPS logged data at a 1 Hz rate.

Following completion of the Waikoloa GPO, USA acquired some additional data at the Waimea GPO plot. The project team surveyed a set of transect lines over the center of the 300' plot. Additionally, the project team surveyed the entire known grid, and completed a meandering path transect over the unknown grid.

NAEVA performed final data processing and analysis at their corporate office in Virginia. USA also issued a purchase order (PO) to Geophysical Associates, at no cost to the government, to evaluate the effectiveness of geological basalt discrimination (basalt background noise has the same spatial and

amplitude response as potential OE) using the four lower coil time gate data provided by the EM61MK2. The results of the basalt discrimination are provided under separate cover as an addendum to this report.

## **F.2 GPO OBJECTIVES**

The purpose of this GPO is to demonstrate and document the site-specific capabilities of the proposed sensors (Multi-gate pulsed electromagnetic induction); navigation equipment (RTK DGPS); geophysical survey method (grid, transect, and meandering path); data transfer, processing and analysis; data management and associated equipment; and personnel to operate as an integrated system capable of meeting data quality objectives (DQOs) for the Phase III OE Engineering Evaluation and Cost Analysis (EE/CA) of the former Waikoloa Maneuver Area. Refer to the Location Map, and Site Maps in section B11. The project team utilized and buried the full range of inert UXO (e.g., smallest to largest) in realistic site conditions, depths, and orientations to document reliable detection capabilities. Based upon this on-site demonstration, USA recommends the best technology for use in subsequent OE EE/CA tasks.

A secondary purpose of the GPO plot is to provide a site-specific equipment and personnel quality control (QC) area or test strip to evaluate and document daily performance in accordance with the project Data Quality Objectives (DQOs). The project team will compare the daily QC data to the original GPO data to verify sensor detection performance, navigation accuracy, data processing and analysis consistency, and results reporting (e.g. target locations) accuracy.

## **F.3 GPO ACTIVITY SUMMARY**

This section documents the sequence of events for this GPO. USA shipped all equipment directly to the hotel for arrival prior to mobilization. USA subcontracted the site geophysicist position to NAEVA Geophysics, Inc.

- Sunday, 7 September 2003, the USA team mobilized to the project site and secured all equipment from the hotel office. USA charged all batteries.
- Monday, 8 September 2003, the USA team:
  - Acquired supplies to assemble the 4-foot high coil nulling table
  - Located the Power Line survey control monument with Base DGPS set up on a GPO corner
  - Acquired a static background and spike test and two lines of data to exercise equipment and test data transfer from Hawaii to NAEVA's and Geophysical Associates corporate offices in Virginia
  - Charged all batteries
- Tuesday, 9 September 2003, the USA team:
  - Set up Base DGPS at Power Line Survey Control Point
  - Set up EM61MK2 in stretcher mode
  - Warmed up the EM61MK2 and acquired static background and spike test
  - Acquired the background survey over the east half of the Contractors' grid
  - Acquired a post-survey static background and spike test
  - Acquired a pre-survey static background and spike test
  - Acquired the known grid survey data
  - Acquired a post-survey static background and spike test
  - Down loaded and transferred all data

- Processed and analyzed the Contractors' grid background data for additional seed item locations
  - Charged all batteries.
- Wednesday, 10 September 2003, the USA team:
  - Set up Base DGPS at Power Line Survey Control Point
  - Seeded Contractors' grid with:
    - 75mm projectile – flush buried, horizontal, east/west
    - 81mm mortar – flush buried, horizontal, east/west
    - 60mm mortar – flush buried, horizontal, east/west, and
    - 81mm mortar buried 1-foot deep, , horizontal, east/west
  - RTK DGPS surveyed the seed item center locations and digitally photographed each
  - Set up EM61MK2 in stretcher mode
  - Warmed up the EM61MK2 and acquired static background and spike test
  - Acquired the complete Contractors' grid survey data
  - Acquired a post-survey static background and spike test
  - Acquired a pre-survey static background and spike test
  - Acquired the Unknown grid survey data
  - Acquired a post-survey static background and spike test
  - Down loaded and transferred all data
  - Processed and analyzed survey data for reacquisition
  - Uploaded 10 selected anomaly locations into RTK DGPS controller
  - Charged all batteries
- Thursday, 11 September 2003, the USA team:
  - Set up Base DGPS at Power Line Survey Control Point
  - Reacquired 10 selected anomalies with RTK DGPS and flagged each location
  - Refined reacquired locations with EM61MK2 in wheel mode and marked refined location with a second flag
  - Recovered Base DGPS and moved to Waimea GPO plot
  - Set Base DGPS on GPO corner
  - Set up EM61MK2 in stretcher mode,
  - Acquired static background and spike test
  - Acquired 2 transects and 1 repeat line through 300-foot plot center
  - Acquired known grid survey
  - Acquired a meandering path survey through the unknown grid
  - Acquired a post-survey static background and spike test
  - Recovered all gear and prepared to demobilize
- Friday, 12 September 2003:

- USA shipped equipment back
- NAEVA site geophysicist demobilized
- USA personnel transitioned to the site visit task

Figure B-1 below shows the EM61MK2 and rover RTK DGPS deployed in the stretcher mode at the Waikoloa GPO. Figure B-2 below shows the base RTK DGPS set up at the Power Line survey control point.



**FIGURE F- 1: EM61MK2 AND RTK DGPS AT THE WAIKOLOA GPO DEPLOYED IN STRETCHER MODE**



**FIGURE F-2: RTK DGPS SET UP AT POWER LINE CONTROL POINT**

#### **F.4 BASE STATIONS FOR THE RTK DGPS**

Two different Base Stations were used for the RTK DGPS, one for the Waikoloa GPO and one for the Waimea GPO. USA used the Power Line base station for the Waikoloa GPO grid surveys of all three grids and anomaly reacquisition. At the Waimea GPO, USA used the GPO northeast corner as the base RTK DGPS location for the known grid survey, the transect survey through the center of all three grids, and the meandering path survey through the unknown grid.

##### **F.4.1 POWER LINE RTK DGPS BASE STATION**

USA used the Power Line RTK DGPS base station for the Waikoloa GPO and anomaly reacquisition. USA checked the positional accuracy by placing the rover GPS antenna over two GPO grid corners. The location obtained using the Power Line base station agreed with the GPO corner locations provided by the USAESCH within 2 inches (5 cm). The coordinates for the Power Line Survey Control Point follow:

- WGS84 coordinates
  - Lat 19 degrees 55 minutes 04.8256" North
  - Lon 155 degrees 47 minutes 04.8746" West
  - Hgt 331.311 meters

- UTM coordinates, NAD83 CONUS Zone 5N
  - Northing 2204822.86754 m
  - Easting 208467.87631 m
  - Elevation 331.3710 m

#### F.4.2 WAIMEA NORTHEAST CORNER RTK DGPS BASE STATION

USA used the northeast corner of the Waimea GPO as the RTK DGPS base station for the Waimea GPO known grid survey, the transect survey through all three grid centers, and the meandering path survey through the unknown grid. USA checked the positional accuracy by placing the rover GPS antenna over two other GPO grid corners. The location obtained using northeast corner coordinate (provided by ATI) agreed with the GPO corner locations provided by ATI within 2 inches (5 cm). The coordinates for the Waimea northeast corner follow:

- WGS84 coordinates
  - Lat 20 degrees 01 minutes 30.47373" North
  - Lon 155 degrees 41 minutes 50.80067" West
  - Hgt 768.565 meters
- UTM coordinates, NAD83 Hawaii Zone 5N
  - Northing 2216538.310 m
  - Easting 217797.650 m
  - Elevation 768.565 m

### F.5 AS BUILT GPO

#### F.5.1 WAIKOLOA GPO

The USAESCH built the Waikoloa GPO grid. This test plot consisted of three (3) roughly 100' x 100' grids oriented approximately east/west. Section B.11 of this report provides the "As Built" map (Waikoloa GPO Site Map) of the Waikoloa GPO.

USA surveyed each of these grids in the full grid survey method with survey lines spaced 2-feet apart. The USAESCH provided the grid coordinates to USA. Table B-1 lists the grid coordinates.

**TABLE F- 1: WAIKOLOA GPO GRID CORNERS**

<b>X Easting</b>	<b>Y Northing</b>	<b>Z Elevation</b>	<b>Description</b>
207948.4663	2205411.6330	286.8136	SW Corner
207942.9233	2205442.8440	285.7008	NW Corner
207973.1995	2205446.7530	287.0335	N INT1
208003.1487	2205452.4560	287.5492	N INT2
208033.2694	2205457.4370	288.3819	NE Corner
208038.5737	2205427.5200	288.1861	SE Corner
208008.4808	2205422.3010	287.3742	S INT2
207976.8633	2205416.6560	287.1385	S INT1
Coordinates are NAD83 CONUS, UTM Zone 5N with units in meters			

**F.5.2 UNKNOWN GRID**

The unknown grid is a blind grid to USA and no information is available to describe how this grid was built.

**F.5.3 CONTRACTORS' GRID**

USA surveyed the eastern half of contractors' grid prior to USA's seeding. USAESCH provided four (4) additional seed items for USA to seed. These included a 75mm projectile, a 60 mm mortar, and two 81mm mortars. Utilizing the background survey, USA seeded these items as shown in the table below. USA assumed that the USAESCH used the western portion of the contractors' grid to bury Quality Control (QC) items. USA has no knowledge of these objects.

**TABLE F- 2: ADDITIONAL SEED ITEMS**

ID	Item	Center of Item			Ruler	Inc. (dip)*	Orient.**
		Easting	Northing	Elev.	Depth (m)	Est. Degrees	Est. Degrees
93	81mm Flush	208024.900	2205455.442	288.430	0.0000	0	90
109	75mm Flush	208027.700	2205450.155	288.286	0.0000	0	90
110	81mm @ 1'	208025.035	2205449.370	288.036	0.3048	0	90
111	60mm Flush	208030.420	2205455.215	288.485	0.0000	0	90
NAD83 CONUS, UTM Zone 5 N, meters						* 0 = horizontal	** 90 = East

**F.5.4 KNOWN GRID**

The USAESCH provided the information on the known grid to USA. Table B-3 lists the known grid ground truth.

**TABLE F- 3: WAIKOLOA KNOWN GRID GROUND TRUTH**

Gnd. Elev.	ID	Item	Tail or Center if small or vert.			Center of Item			Nose of Item			Total Sta.	Inc. (dip)	
			Easting	Northing	Elev.	Easting	Northing	Elev.	Easting	Northing	Elev.	Depth(m)	est. degrees*	
287.016	w001	155mm	207949.948	2205422.710	286.162	207949.764	2205422.538	286.257	207949.523	2205422.343	286.296	0.720	-5	
286.270	w002	155mm	207950.502	2205438.219	285.333	207950.510	2205438.096	285.411	207950.701	2205437.911	285.247	0.859	20	
287.512	w003	105mm smoke	207961.162	2205420.649	286.953				207960.936	2205420.503	286.679	0.560	75	
286.169	w004	105mm smoke	207947.625	2205434.585	285.266	207947.574	2205434.393	285.321	207947.555	2205434.235	285.335	0.834	-4	
287.635	w005	105mm smoke	207955.631	2205420.033	286.461	207955.733	2205420.105	286.623	207955.893	2205420.049	286.541	1.012	0	
285.976	w009	105mm TP	207947.161	2205437.897	285.157	207947.329	2205437.894	285.151	207947.532	2205437.895	285.125	0.819	4	
287.300	w011	105mm illum	207953.070	2205423.050	286.845	207952.931	2205423.241	286.884	207952.787	2205423.280	286.756	0.416	7	
286.912	w012	4.2" mortar	207954.370	2205432.416	286.217	207954.534	2205432.507	286.226	207954.716	2205432.617	286.137	0.687	0	
287.195	w013	4.2" mortar	207952.554	2205426.113	286.500	207952.386	2205426.044	286.596	207952.174	2205425.955	286.516	0.679	-3	
287.364	w015	105mm HEAT TP	207951.404	2205415.265	286.565	207951.216	2205415.373	286.632	207950.899	2205415.421	286.551	0.732	5	
286.175	w023	75mm	207949.585	2205440.492	285.420	207949.585	2205440.492	285.420				0.755	75	
287.548	w024	75mm	207955.712	2205423.807	287.182	207955.611	2205423.893	287.260	207955.617	2205424.018	287.179	0.288	0	
285.924	w027	75mm	207946.492	2205440.259	285.370	207946.475	2205440.355	285.370	207946.457	2205440.467	285.370	0.554	not estimated	
286.680	w028	75mm	207956.225	2205438.536	286.204	207956.247	2205438.482	286.372	207956.231	2205438.264	286.290	0.390	-5	
287.218	w030	2.36" rocket	207957.289	2205416.523	286.938	207957.490	2205416.639	286.951	207957.575	2205416.777	286.961	0.257	0	
287.219	w034	2.36" rocket	207960.168	2205443.036	286.836	207960.243	2205442.909	286.862	207960.341	2205442.755	286.866	0.353	-10	
286.679	w035	2.36" rocket	207950.492	2205432.072	286.430	207950.799	2205432.117	286.396	207950.898	2205431.934	286.424	0.248	40	
287.345	w037	60mm practice mortar(illum)	207952.940	2205420.411	287.130	207952.940	2205420.411	287.130				0.215	85	
287.477	w039	60mm practice mortar	207953.680	2205417.450	287.164	207953.680	2205417.450	287.164				0.313	65	
287.464	w040	60mm practice mortar	207953.267	2205415.501	287.223	207953.267	2205415.501	287.223				0.241	85	
287.281	w042	60mm practice mortar	207959.363	2205436.749	286.934	207959.363	2205436.749	286.934				0.348	75	
287.196	w047	37mm	207953.744	2205429.423	287.080	207953.744	2205429.423	287.080				0.116	0	
286.178	w050	37mm	207947.866	2205432.718	286.011	207947.866	2205432.718	286.011				0.167	0	
286.548	w051	37mm	207951.311	2205434.617	286.313	207951.311	2205434.617	286.313				0.235	75	
287.022	w052	37mm	207949.683	2205428.305	286.839	207949.683	2205428.305	286.839				0.183	0	
287.626	w053	37mm	207964.920	2205434.534	287.522	207964.920	2205434.534	287.522				0.104	8	
287.511	w055	rifle grenade	207959.223	2205433.536	287.395				207959.377	2205433.529	287.423	0.088	0	
286.789	w056	rifle grenade	207948.233	2205425.891	286.597	207948.233	2205425.891	286.597				0.192	0	
287.338	w057	rifle grenade	207960.847	2205440.059	287.153	207960.889	2205439.902	287.106	207960.954	2205439.794	287.028	0.184	20	
286.970	w058	rifle grenade	207957.186	2205441.867	286.711	207957.232	2205441.960	286.714	207957.283	2205442.057	286.733	0.237	0	
287.584	w060	rifle grenade	207962.082	2205435.153	287.384	207962.012	2205435.045	287.376	207961.927	2205435.020	287.372	0.199	10	
													*neg =nose up	
			Coordinates are in NAD83 CONUS UTM Zone 5 North, units in meters											0=horizontal

**F.5.5 PHOTOGRAPHS OF SEED ITEMS PLACED BY USA**

Photographs of the four (4) additional seed items that USA placed in the contractors' grid are show below.



**FIGURE F- 3. SEED 109 75MM FLUSH**



**FIGURE F- 4. SEED 93 81MM FLUSH**



**FIGURE F- 5: SEED 110 81MM 1-FOOT**



**FIGURE F- 6: SEED 111 60MM FLUSH**

### F.5.6 WAIMEA GPO

The USAESCH established the Waimea GPO. Like the Waikoloa GPO, the Waimea GPO consisted of three adjacent grids, each roughly 100' x 100', for a total GPO plot roughly 100' x 300', oriented approximately northeast/southwest. Section B.11 of this report provides the “As Built” map (Waimea GPO Site Map) of the Waimea GPO (Note that USA has no knowledge of the Waimea Government/Contractors’ grid seeding).

USA surveyed the known grid using the grid survey method with survey lines every 2-feet. USA acquired a 300’ transect survey through the center of all three grids (known, unknown, and contractors’ grids) with two adjacent lines spaced 2-feet apart. Finally, USA acquired a meandering path survey through and around the unknown grid in a single pass.

ATI initially used this plot. USA did not place any additional seed items in the Waimea Contractors’ grid and has no information concerning targets that either USAESCH or ATI placed in the Contractors’ grid. The Waimea GPO grid corner locations and the seed items in the known grid follow:

**TABLE F- 4: WAIMEA GPO GRID CORNERS**

Corrected Easting	Corrected Northing	Original Easting	Original Northing	Elevation	ID
217797.650	2216538.310	212564.0513	2216623.616	768.5649958	NE CORNER
217822.800	2216450.260	212588.8443	2216535.529	770.9702335	SE CORNER
217768.170	2216529.920	212534.5563	2216615.317	767.9241842	NW CORNER
217793.520	2216441.930	212559.4854	2216527.293	771.6222007	SW CORNER
217814.179	2216479.598	212580.5692	2216564.935	770.4754822	E INT1
217805.911	2216508.966	212572.3013	2216594.303	769.062216	E INT2
217776.584	2216500.725	212542.9735	2216586.062	768.5211046	W INT2
217784.779	2216471.290	212551.1694	2216556.627	769.0878497	W INT1
Coordinates are NAD83 Hawaii UTM Zone 5N with units in meters					

**TABLE F- 5: WAIMEA KNOWN GRID GROUND TRUTH**

Gnd. Elevation	Nose, Tail, Center of Item ID	Item	Orig. Easting	Orig. Northing	Corrected Easting	Corrected Northing	Survey Depth(in)	Inclination (degrees)
	NE GRID CORNER		212564.05	2216623.62	217797.65	2216538.31		0=horizontal
	SE GRID CORNER		212588.84	2216535.53	217822.80	2216450.26		pos degrees=nose down
	NW GRID CORNER		212534.56	2216615.32	217768.17	2216529.92		neg degrees=nose up
	SWGRID CORNER		212559.49	2216527.29	217793.52	2216441.93		
	E INT1		212580.57	2216564.94	217814.27	2216479.60		
	E INT2		212572.30	2216594.30	217806.00	2216508.97		
	W INT2		212542.97	2216586.06	217776.67	2216500.73		
	W INT1		212551.17	2216556.63	217784.87	2216471.29		
769.81	W010center	4.2" mortar	212559.63	2216549.65	217793.33	2216464.31	38.01	0
769.81	W010nose		212559.58	2216549.84	217793.28	2216464.50	38.81	
769.81	W010tail		212559.68	2216549.49	217793.38	2216464.15	38.68	
769.85	W016center	105mm HEAT	212562.61	2216553.08	217796.31	2216467.75	31.69	0
769.85	W016nose		212562.42	2216552.95	217796.12	2216467.62	33.97	
769.85	W016tail		212562.77	2216553.24	217796.47	2216467.90	32.14	
770.83	W017center	75mm proj	212569.96	2216534.13	217803.66	2216448.80	23.04	15
770.83	W017nose		212569.84	2216534.14	217803.54	2216448.80	25.54	
770.83	W017tail		212570.04	2216534.13	217803.74	2216448.79	21.70	
770.71	W018center	75mm proj	212570.82	2216539.43	217804.52	2216454.09	26.26	6
770.71	W018nose		212570.72	2216539.43	217804.42	2216454.09	27.46	
770.71	W018tail		212570.90	2216539.47	217804.60	2216454.13	25.03	
770.50	W020center	75mm proj	212574.35	2216543.00	217808.05	2216457.66	13.27	3
770.50	W020nose		212574.24	2216542.98	217807.94	2216457.64	14.34	
770.50	W020tail		212574.49	2216543.01	217808.19	2216457.68	13.28	
769.94	W021center	75mm proj	212568.69	2216558.96	217802.39	2216473.63	27.23	-5
769.94	W021nose		212568.58	2216558.97	217802.28	2216473.63	25.71	
769.94	W021tail		212568.78	2216558.95	217802.48	2216473.61	28.71	
770.77	W031center	2.36" rocket	212575.68	2216536.76	217809.38	2216451.43	11.43	30

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Gnd. Elevation	Nose, Tail, Center of Item ID	Item	Orig. Easting	Orig. Northing	Corrected Easting	Corrected Northing	Survey Depth(in)	Inclination (degrees)
770.77	W031nose		212575.64	2216536.91	217809.34	2216451.57	17.13	
770.77	W031tail		212575.70	2216536.62	217809.40	2216451.28	6.40	
771.04	W033center	2.36" rocket	212563.31	2216532.94	217797.01	2216447.60	22.21	2
771.04	W033nose		212563.13	2216532.97	217796.83	2216447.63	22.79	
771.04	W033tail		212563.54	2216532.93	217797.24	2216447.59	22.09	
770.82	W064center	37mm	212582.16	2216536.87	217815.86	2216451.54	0.97	0
770.47	W061center	37mm	212578.84	2216548.68	217812.54	2216463.34	11.62	0
770.75	W062center	37mm	212580.50	2216542.74	217814.20	2216457.41	7.10	0
770.79	W063center	37mm	212581.42	2216539.93	217815.12	2216454.60	3.91	0
770.61	W065center	37mm	212579.71	2216545.50	217813.41	2216460.17	15.06	0
770.25	W066center	37mm	212576.29	2216557.52	217809.99	2216472.18	4.12	0
770.33	W068center	37mm	212577.08	2216554.43	217810.78	2216469.09	8.80	0
770.42	W069center	37mm	212578.26	2216551.45	217811.96	2216466.11	13.88	0
770.25	W071center	smoke grenade	212578.04	2216562.71	217811.74	2216477.37	10.85	0
770.33	W073center	smoke grenade	212578.79	2216559.83	217812.49	2216474.49	8.39	0
770.13	W075center	rifle grenade	212573.20	2216555.75	217806.90	2216470.41	14.55	0
770.13	W075nose		212573.18	2216555.66	217806.88	2216470.32	13.75	
770.13	W075tail		212573.20	2216555.87	217806.90	2216470.54	15.42	
769.69	W077center1	rifle grenade	212560.40	2216557.75	217794.10	2216472.42	9.70	0
769.69	W077nose1		212560.40	2216557.70	217794.10	2216472.36	9.77	
769.69	W077tail1		212560.36	2216557.85	217794.06	2216472.51	11.27	
770.84	W079center	hand grenade (MKII)	212584.83	2216539.00	217818.53	2216453.66	1.64	0
770.48	W080center	hand grenade (MKII)	212580.49	2216553.97	217814.19	2216468.63	17.67	0
770.17	W085center	grenade fuze	212575.40	2216560.34	217809.10	2216475.00	1.61	
770.81	W081center	hand grenade (MKII)	212583.93	2216542.07	217817.63	2216456.73	5.06	0
770.72	W082center	hand grenade (MKII)	212582.93	2216544.93	217816.63	2216459.60	11.27	0
770.62	W083center	hand grenade (MKII)	212582.03	2216547.95	217815.73	2216462.62	6.88	0
770.56	W084center	hand grenade (MKII)	212581.37	2216551.00	217815.07	2216465.66	14.46	0
770.42	W086center	M48 fuze	212579.74	2216556.95	217813.44	2216471.61	5.11	
770.68	W091nose	81mm	212565.36	2216539.21	217799.06	2216453.87	25.27	10
770.68	W091tail		212565.11	2216539.06	217798.81	2216453.73	23.23	
770.47	W092nose	81mm	212560.93	2216542.09	217794.63	2216456.76	31.18	0

<b>Gnd. Elevation</b>	<b>Nose, Tail, Center of Item ID</b>	<b>Item</b>	<b>Orig. Easting</b>	<b>Orig. Northing</b>	<b>Corrected Easting</b>	<b>Corrected Northing</b>	<b>Survey Depth(in)</b>	<b>Inclination (degrees)</b>
770.47	W092tail		212560.94	2216542.34	217794.64	2216457.00	31.15	
770.04	W095nose	81mm	212567.48	2216554.26	217801.18	2216468.92	27.73	0
770.04	W095tail		212567.27	2216554.40	217800.97	2216469.06	28.98	0
770.38	W102tail	60mm	212569.31	2216544.93	217803.01	2216459.59	21.47	75
769.29	W105nose	60mm	212555.33	2216553.61	217789.03	2216468.27	19.59	0
769.29	W105tail1		212555.48	2216553.71	217789.18	2216468.37	19.41	
770.35	W107nose	60mm	212575.76	2216548.38	217809.46	2216463.04	15.29	0
770.35	W107tail		212575.66	2216548.50	217809.36	2216463.16	15.65	

## F.6 COLOR MAPS OF GEOPHYSICAL DATA

USA's geophysical subcontractor, NAEVA Geophysics, processed and analyzed the GPO survey and QC data at their corporate headquarters in Virginia. This section documents the data processing and analysis performed. Section B.11 of this report provides color image maps of each 100' x 100' grid, transect, and meandering path surveys. Overlays include grid corners, known seed item locations, selected targets from analysis, and anomalies selected for reacquisition demonstration.

### F.6.1 DATA PROCESSING

The project team downloaded the field survey data from the data logger and converted from \*.R61 file format to a \*.M61 format using Geonics' DATMK2 software. The project team then used Microsoft Excel to reformat the \*.M61 data files for Geosoft import, processing, and analysis. In Geosoft's OASIS montaj, the project team converted the WGS84 survey Latitude, Longitude positions to UTM Zone 5N, with units in meters.

NAEVA's Geophysicist/Analyst used Geosoft's OASIS montaj to:

- Assess static background noise levels, and uniform response to a known test object (2" tow ball)
- Check data gaps along track and line spacing across track
- Check RTK DGPS positioning

The major data processing steps included:

- Drift correction filtering of each time gate,
- Leveling each time gate,
- Lag correcting each time gate,
- Removing the daily QC data from the survey file into a separate database, and
- Gridding the processed time gates

### F.6.2 DATA ANALYSIS

The project team performed analysis of the gridded data on Time Gates 1, 2, and 3. A check of the analysis results from the sum of all 4 time gates did not provide any improved detection, so the project team limited the analysis to the first three time gate channels. In the known grid and in the contractors' grid, the project team used the known seed item locations to determine an appropriate detection threshold for each time gate. For all of the Waikoloa and Waimea GPO grids, the project used the following target selection thresholds:

**TABLE F- 6: DETECTION THRESHOLDS**

Waikoloa	Waimea
Time Gate 1 threshold = 15 mV	Time Gate 1 threshold = 10 mV
Time Gate 2 threshold = 10 mV	Time Gate 2 threshold = 7 mV
Time Gate 3 threshold = 6 mV	Time Gate 3 threshold = 4 mV

The project team used Geosoft's UX-Detect to initially select targets. NAEVA's geophysical analyst manually reviewed all of the selected target to refine and finalize the target selection and generate the final target maps as Geosoft maps. The project team then exported the processed data and targets lists to ASCII format files for delivery.

Section B.11 of this report provides the following color maps:

- EM61MK2 Gate 1 (edited), Waikoloa Geophysical Prove Out (GPO) Contractors' Grid
- EM61MK2 Gate 2 (edited), Waikoloa Geophysical Prove Out (GPO) Contractors' Grid
- EM61MK2 Gate 3 (edited), Waikoloa Geophysical Prove Out (GPO) Contractors' Grid
- EM61MK2 Gate 1 (edited), Waikoloa Geophysical Prove Out (GPO) Known Grid
- EM61MK2 Gate 2 (edited), Waikoloa Geophysical Prove Out (GPO) Known Grid
- EM61MK2 Gate 3 (edited), Waikoloa Geophysical Prove Out (GPO) Known Grid
- EM61MK2 Gate 1 (edited), Waikoloa Geophysical Prove Out (GPO) Unknown Grid
- EM61MK2 Gate 2 (edited), Waikoloa Geophysical Prove Out (GPO) Unknown Grid
- EM61MK2 Gate 3 (edited), Waikoloa Geophysical Prove Out (GPO) Unknown Grid
- EM61MK2 Gate 1 (edited), Waimea Geophysical Prove Out (GPO) Known Grid
- EM61MK2 Gate 2 (edited), Waimea Geophysical Prove Out (GPO) Known Grid
- EM61MK2 Gate 3 (edited), Waimea Geophysical Prove Out (GPO) Known Grid
- EM61MK2 Gate 1 (edited), Waimea Geophysical Prove Out (GPO) Center Transect
- EM61MK2 Gate 2 (edited), Waimea Geophysical Prove Out (GPO) Center Transect
- EM61MK2 Gate 3 (edited), Waimea Geophysical Prove Out (GPO) Center Transect
- EM61MK2 Gate 1 (edited), Waimea Geophysical Prove Out (GPO) Meandering Path
- EM61MK2 Gate 2 (edited), Waimea Geophysical Prove Out (GPO) Meandering Path
- EM61MK2 Gate 3 (edited), Waimea Geophysical Prove Out (GPO) Meandering Path

## F.7 SUMMARY OF GPO RESULTS

The GPO results are based on the grid surveys of the known grids at the Waikoloa and Waimea GPO plots. Tables B-7 through B-9 summarizes these results. The total number of anomalies selected from the first three EM61-MK2 Time Gates is provided. The number of seeded items detected at a 1.0-meter radius is provided. The probability of detection is calculated as the number of seed items detected divided by the total number of seed items. The false alarm rate (FAR) is also provided. The FAR is calculated by subtracting the number of seed items detected from the total number of anomalies reported and dividing that result by the total number of anomalies reported.

**TABLE F- 7: SELECTED TARGET YIELDS**

GRID	Time Gate 1	Time Gate 2	Time Gate 3
Waikoloa Known	181	148	105
Waikoloa Unknown	139	104	91
Waikoloa Contractors'	143	106	90
Waimea Known	106	95	88

**TABLE F- 8: PROBABILITY OF DETECTION (Pd), 1-METER RADIUS**

GRID	Time Gate 1	Time Gate 2	Time Gate 3
Waikoloa Known	96.8% (30/31)	93.5% (29/31)	90.3% (28/31)
Waimea Known	79.4% (27/34)	79.4% (27/34)	73.5% (25/34)

**TABLE F- 9: FALSE ALARM RATES, 1-METER RADIUS**

GRID	Time Gate 1	Time Gate 2	Time Gate 3
Waikoloa Known	83.4%((181-30)/181)	80.4%((148-29)/148)	73.3%((105-28)/105)
Waimea Known	74.5%((106-27)/106)	71.5%((95-27)/95)	71.6%((88-25)/88)

It is apparent, as one goes to earlier time gates, the Pd improves, but at a significant increase in number of targets (presumably false positives). The Pd is higher at Waikoloa than at Waimea, despite the higher geologic terrain response, due to the difference in seeded items. Seeded items at Waimea tended to be smaller and buried deeper, some beyond detection limits.

USA demonstrated both the Transect and the Meandering Path survey methods at the Waimea GPO. Although USA does not have the ability to “score” these surveys, these two survey techniques offer a method of coarsely characterizing portions of the EE/CA that can not be easily surveyed with the grid method (e.g. rough terrain areas or vegetated areas).

Section B.10 of this report provides the target list for each grid, transect, meandering path survey and each time gate. The results of the demonstrated Anomaly Reacquisition are included in the Waikoloa Known Grid Target List. This was the only task performed with the EM61MK2 operating in the wheeled mode. Although this allowed for one-person operation, the process was extremely rough and time consuming. All anomaly reacquisition results are acceptable for the purposes of this EE/CA.

## **F.8 PROPOSED GEOPHYSICAL EQUIPMENT, TECHNIQUES, AND METHODOLOGIES**

USA is confident that the EM61MK2 will provide the detection required for this phase of the Waikoloa EE/CA. The integrated Trimble RTK DGPS also performed well and is recommended for this phase of the EE/CA.

The stretcher method of deploying the EM61MK2 is also recommended. This sensor deployment technique minimizes the adverse noise effects of the rough terrain, reduces the mechanical fatigue on the equipment, and shares the sensor/positioning load between two operators. Compared to the wheeled mode used during the anomaly reacquisition demonstration at the Waikoloa GPO, the stretcher mode would be more effective.

USA used the grid, transect, and meandering path transect survey methods during this GPO. USA recommends all three methods for area surveying/characterization during this phase of the EE/CA, as deemed appropriate by the Technical Project Planning team.

The standard EM61MK2 data processing and analysis tools (a combination of Geonics, Microsoft, and Geosoft software) proved to be adequate for this GPO. USA recommends processing and analysis of all three bottom coil time gate channels. It is apparent from the analysis of both the Waikoloa and Waimea GPO plots that the project team will need to establish different anomaly selection thresholds for different survey areas, and possibly even within some areas.

## **F.9 SUPPORTING INFORMATION**

In addition to the anomaly selection results provided above, the quality control test data is provided as supporting information.

### **F.9.1 QUALITY CONTROL TESTING**

The USA team performed quality control (QC) testing throughout the field work for this GPO. After equipment warm-up, these tests included static background and spike tests before and after each grid survey, repeat survey lines, cloverleaf position/latency test, and RTK DGPS reoccupation tests. This section documents the results of these tests.

### **F.9.2 STATIC TEST RESULTS**

The project team performed static tests on a non-metallic table, made of cinder blocks, two plastic barrels, two 2" x 4" x 8' timber, and miscellaneous shims to help level the table top. The project team placed the EM61 coil on top of this table at a height of at least 4-feet above the ground surface. All static test results are acceptable. There is some expected drift from the start and end plots. The background noise at the Waikoloa GPO is higher than the background at the Waimea GPO. The complete series of static background and spike test results are provided here as Microsoft Excel plots.

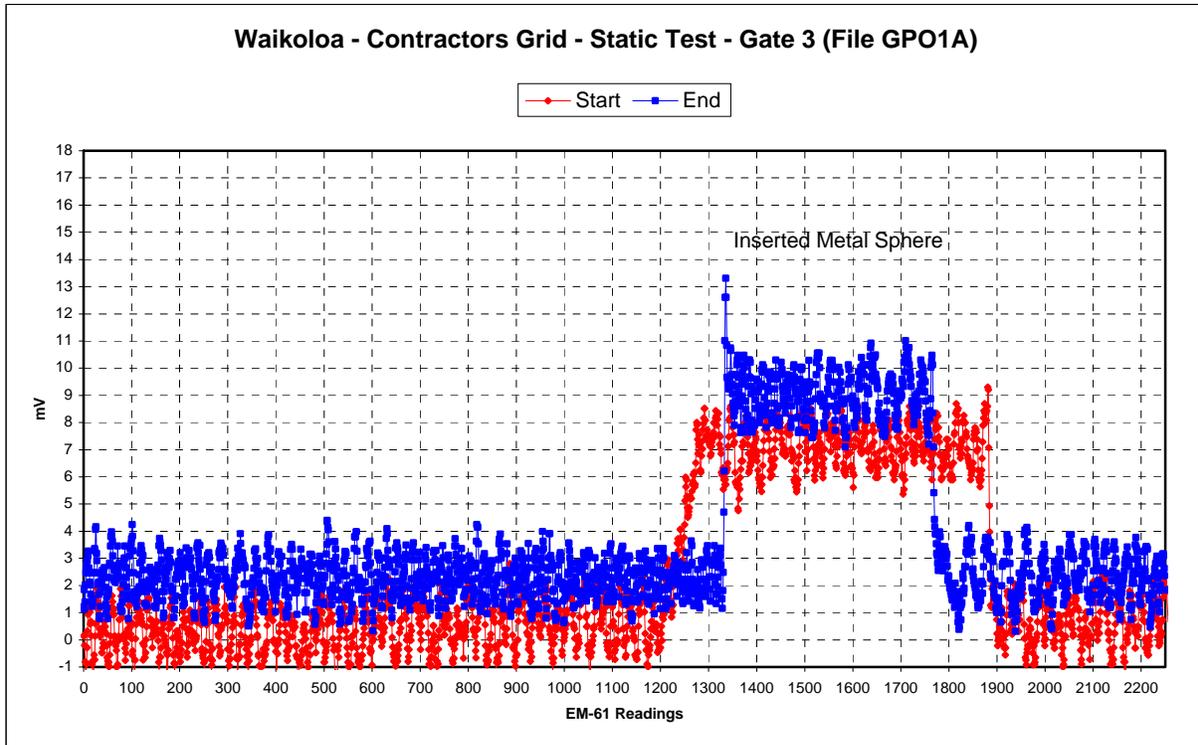


FIGURE F- 7. WAIKOLOA GPO – CONTRACTORS’ GRID STATIC TEST RESULTS

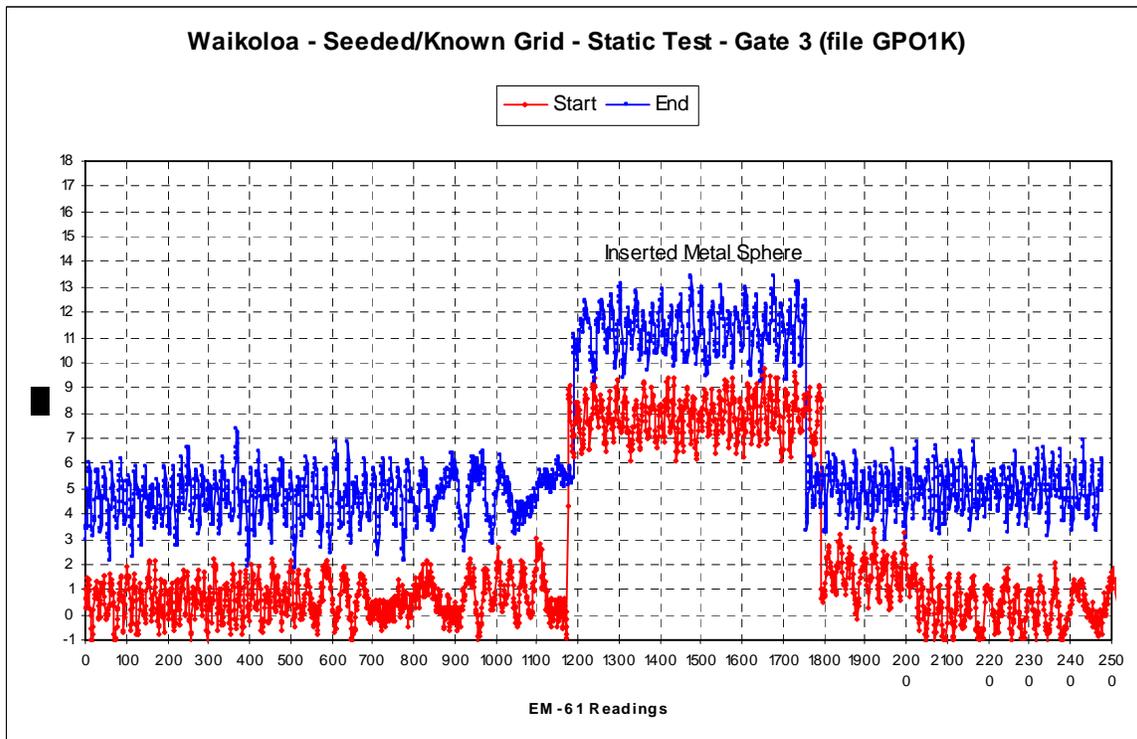


FIGURE F- 8 WAIKOLOA GPO - UNKNOWN GRID STATIC TEST RESULTS

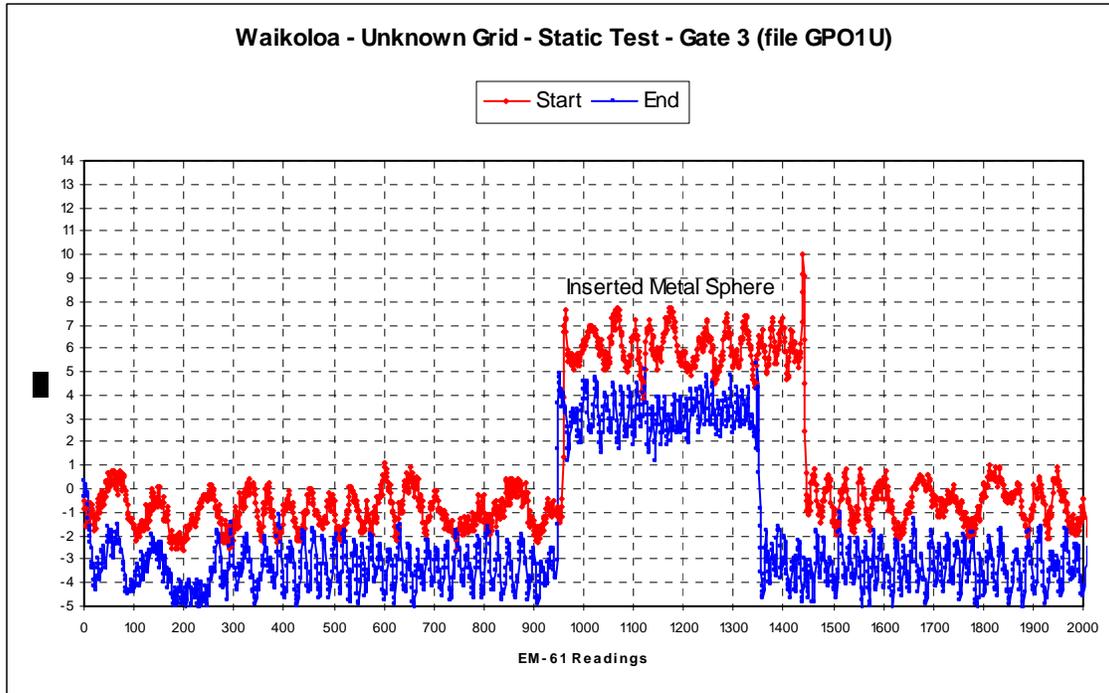


FIGURE F- 9 WAIKOLOA GPO - UNKNOWN GRID STATIC TEST RESULTS

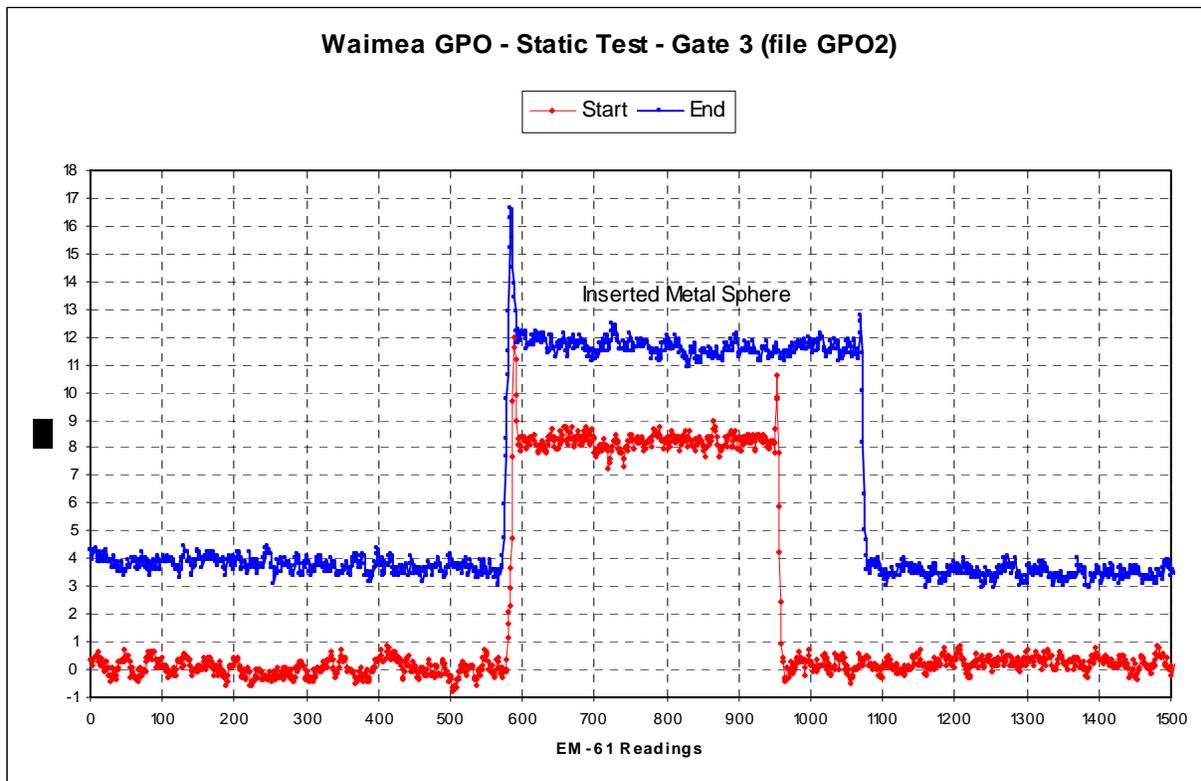
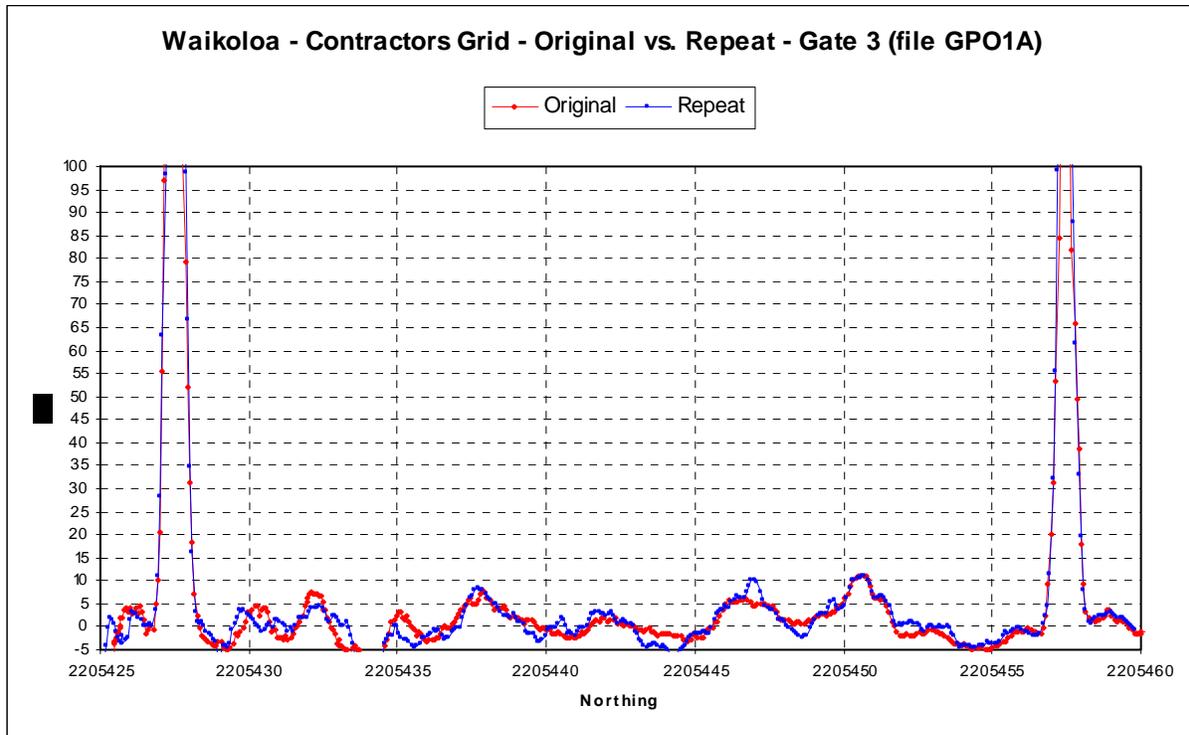


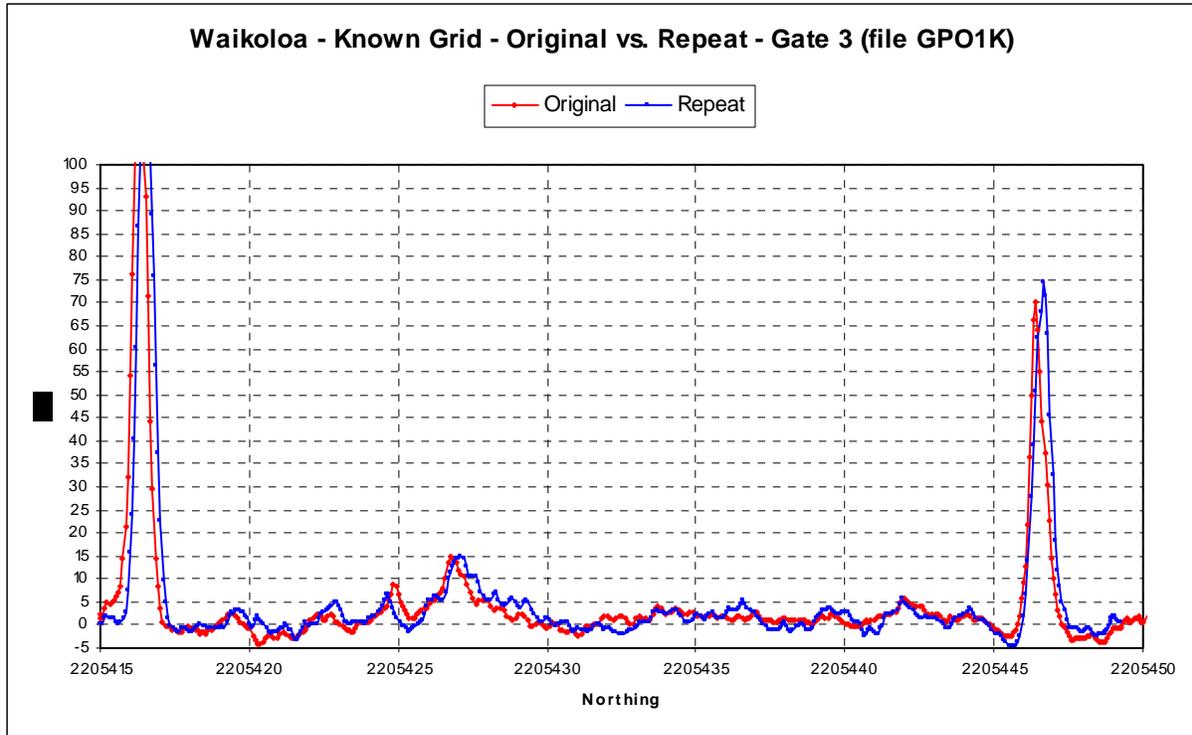
FIGURE F- 10 WAIMEA GPO STATIC TEST RESULTS

### F.9.3 REPEAT LINE QC TEST RESULTS

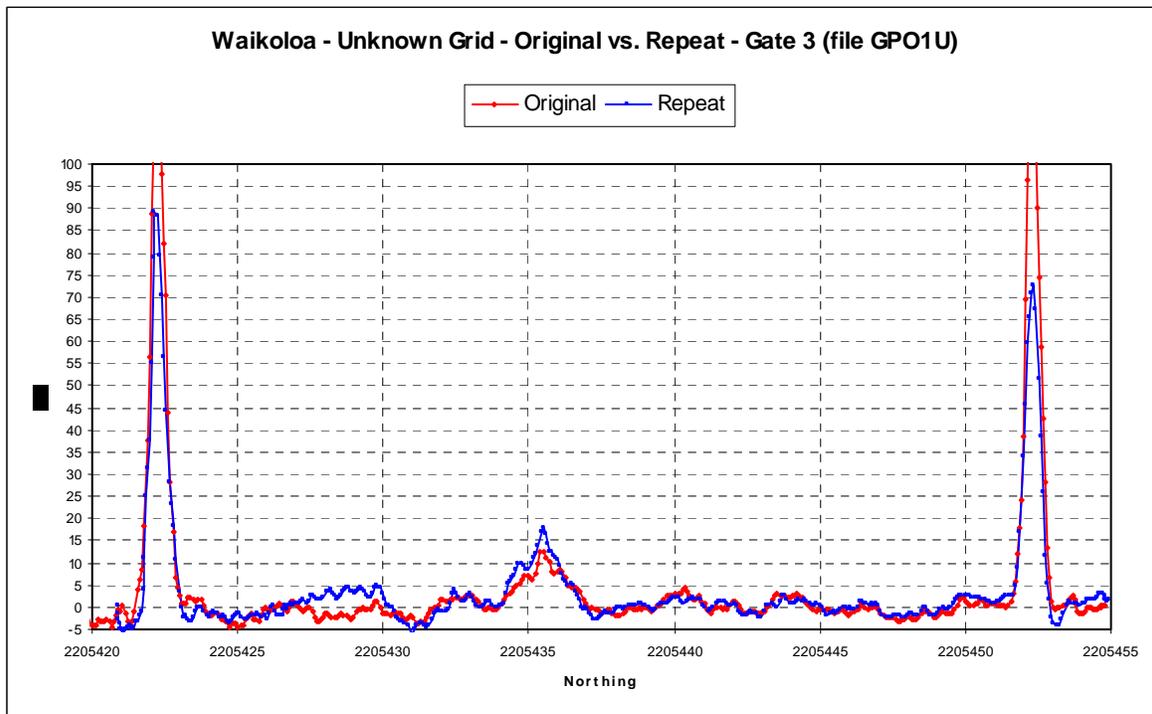
The project team repeated one survey line in each grid survey in the three Waikoloa GPO grids and the Waimea known GPO grid. The project team also performed a 6-Line test at the Waimea GPO. The repeat test results are largely acceptable. There is greater deviation in the Waikoloa GPO repeat tests due to the higher background noise levels. The project team used the 6-Line test results to compliment the cloverleaf tests to establish an appropriate lag correction. The plots for these tests are provided here.



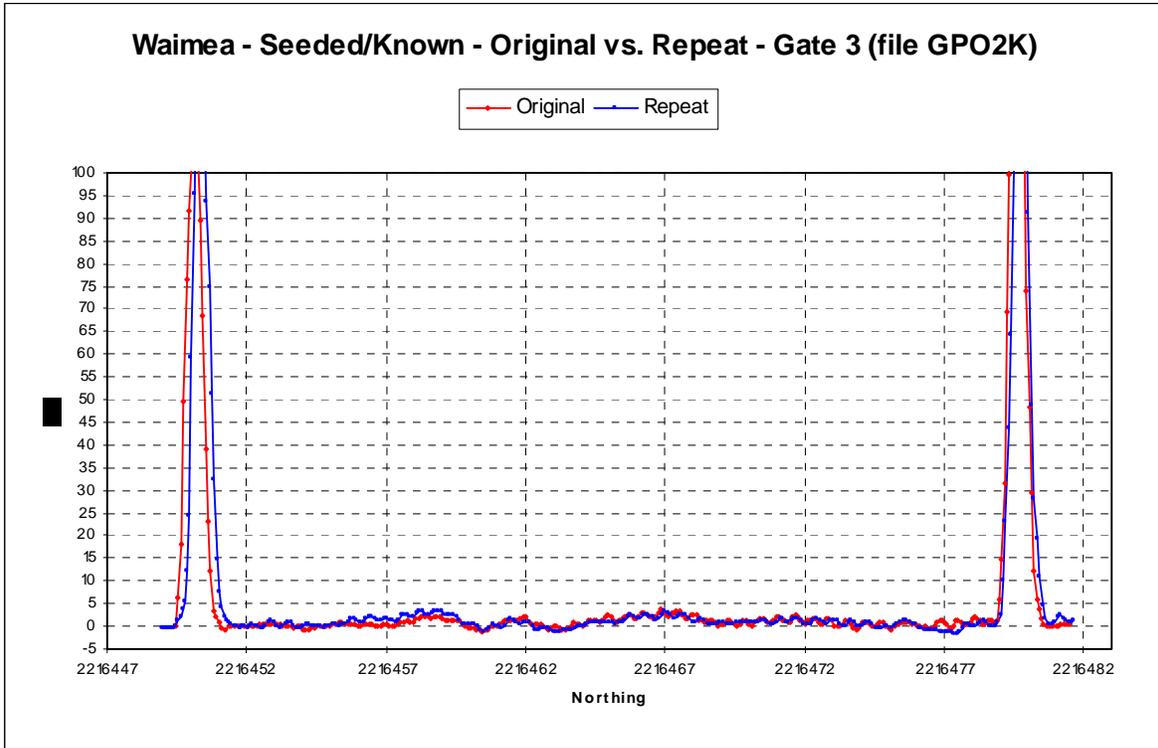
**FIGURE F- 11 WAIKOLOA GPO - CONTRACTORS' GRID REPEAT TEST RESULTS**



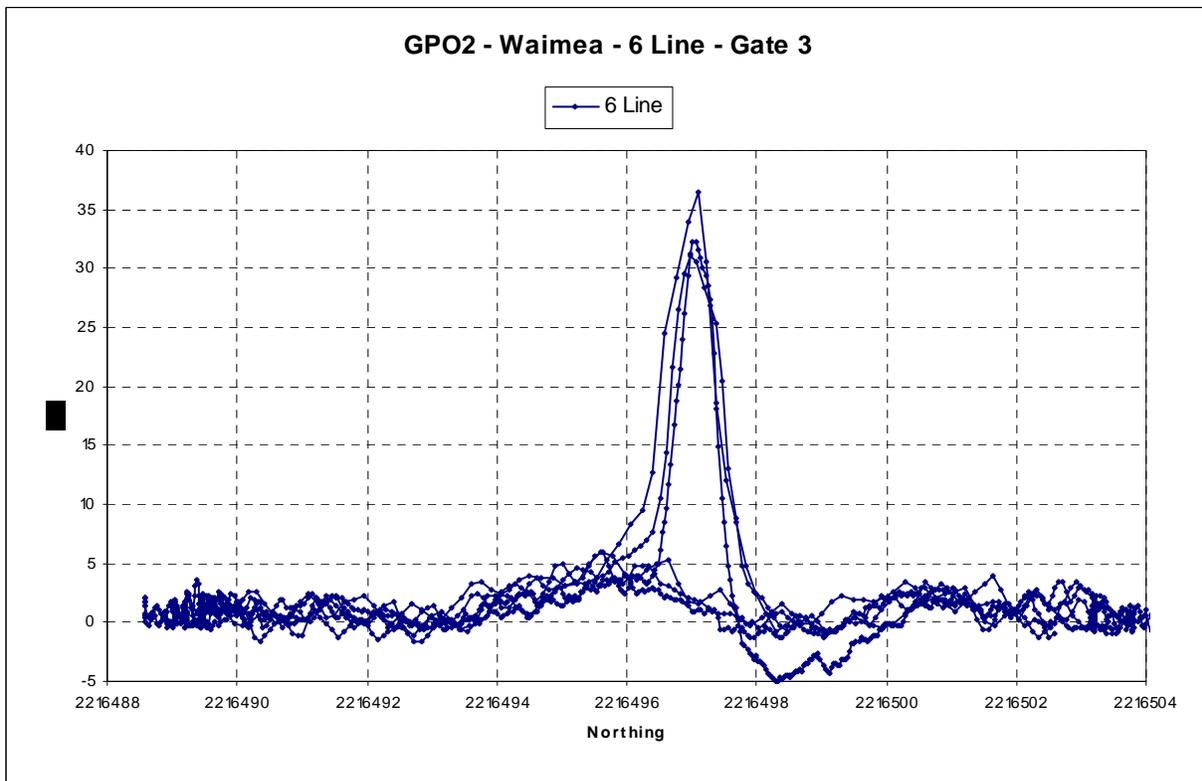
**FIGURE F- 12 WAIKOLOA GPO - KNOWN GRID REPEAT TEST RESULTS**



**FIGURE F- 13 WAIKOLOA GPO - UNKNOWN GRID REPEAT TEST RESULTS**



**FIGURE F- 14 WAIMEA GPO - KNOWN GRID REPEAT TEST RESULTS**



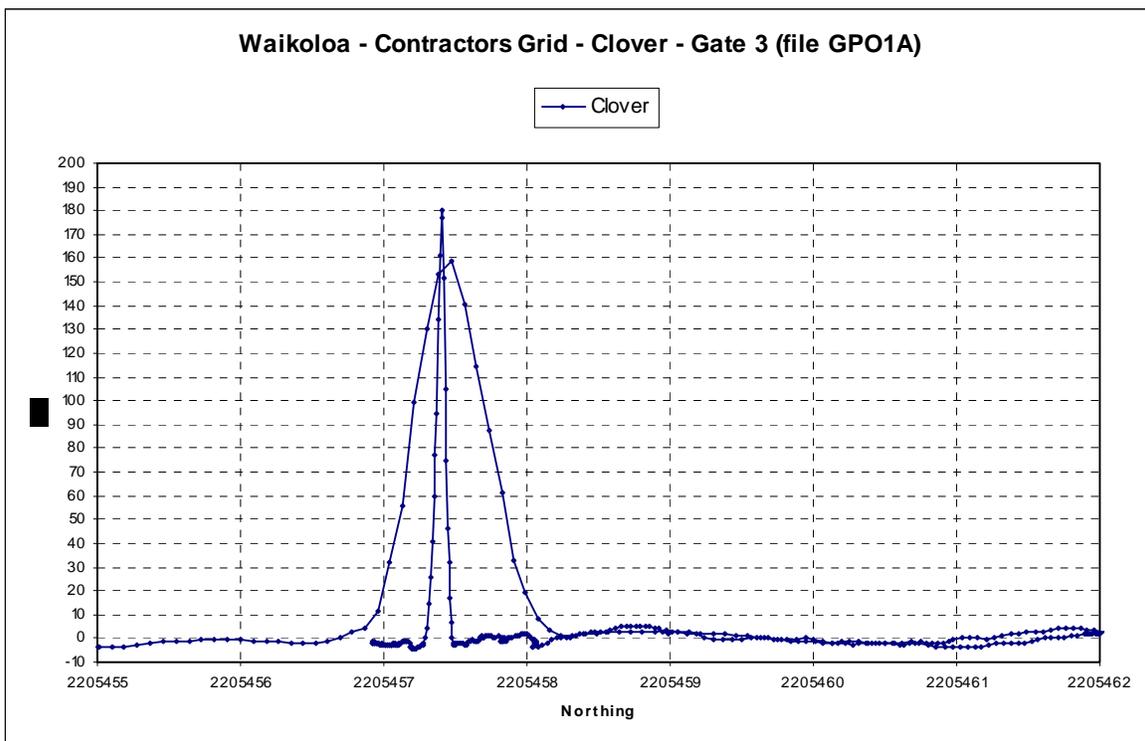
**FIGURE F- 15 WAIMEA GPO - 6-LINE TEST RESULTS**

**F.9.4 RTK DGPS REOCCUPATION TEST RESULTS**

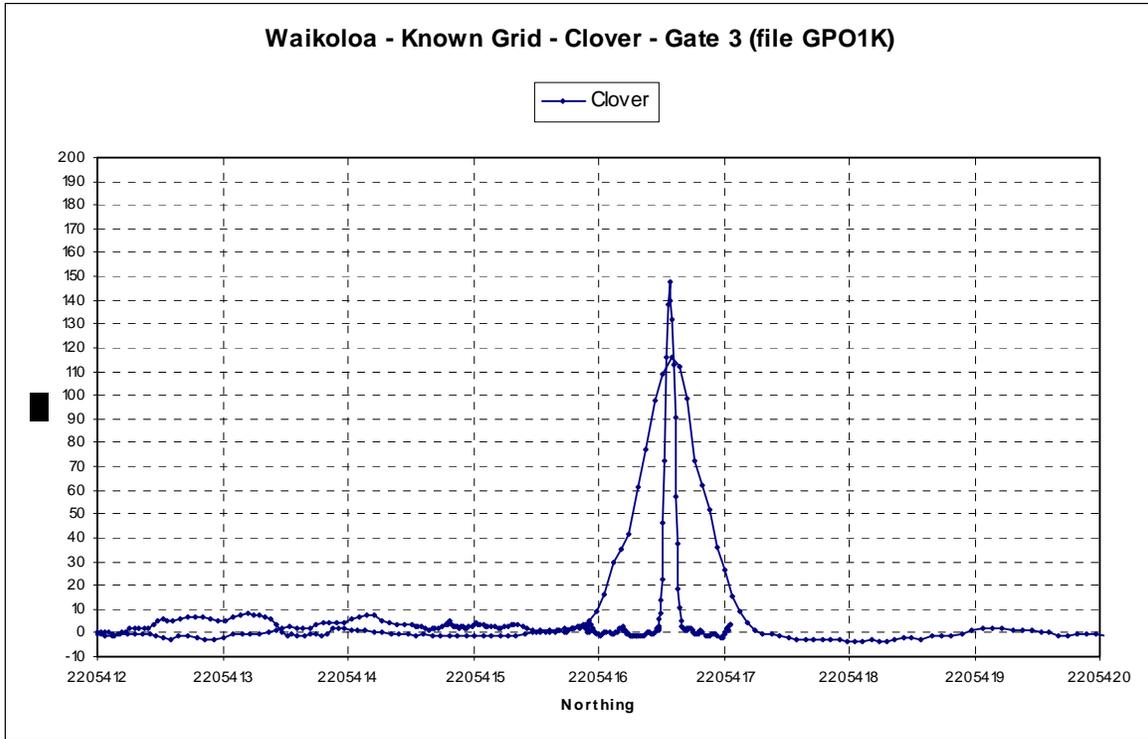
Each day of the GPO, the project team checked the rover RTK DGPS positioning at a known grid corner location. This was done three consecutive days at the Waikoloa GPO and once at the Waimea GPO. The project team compared each test to the coordinates provided by USAESCH. All test results were acceptable (within 2 inches (5 cm)). However, there was no recording of these results in the field therefore no detailed results are available for this report. The RTK DGPS performance was excellent during this GPO.

**F.9.5 CLOVERLEAF TEST RESULTS**

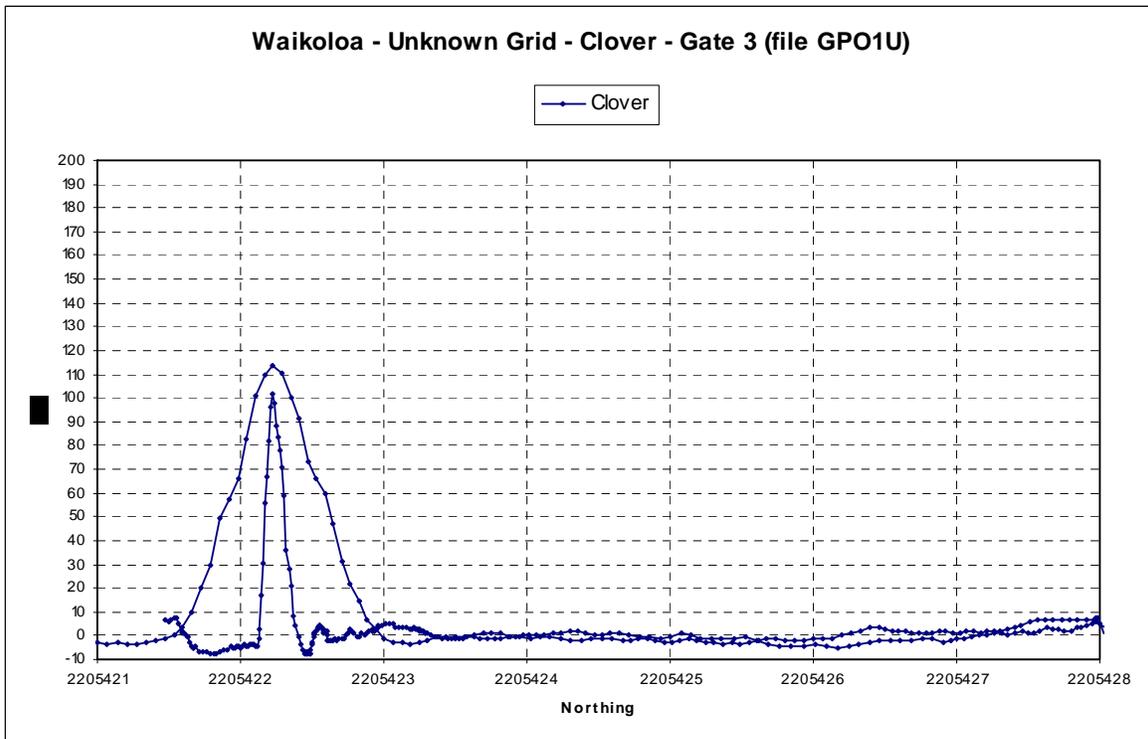
The project team performed the Cloverleaf tests each day to help determine appropriate sensor/positioning lag corrections. The project team acquired data over a grid corner marker in one direction and then looped around to cross the same corner marker at 90 degrees. It is apparent from the data that this test allowed accurate data positioning to within a fraction of the 10 Hz sample interval. The spatial extent of the anomaly is compressed in one direction due to the coordinate (e.g., Northing) used for the X-axis plot. The results of these tests are plotted here.



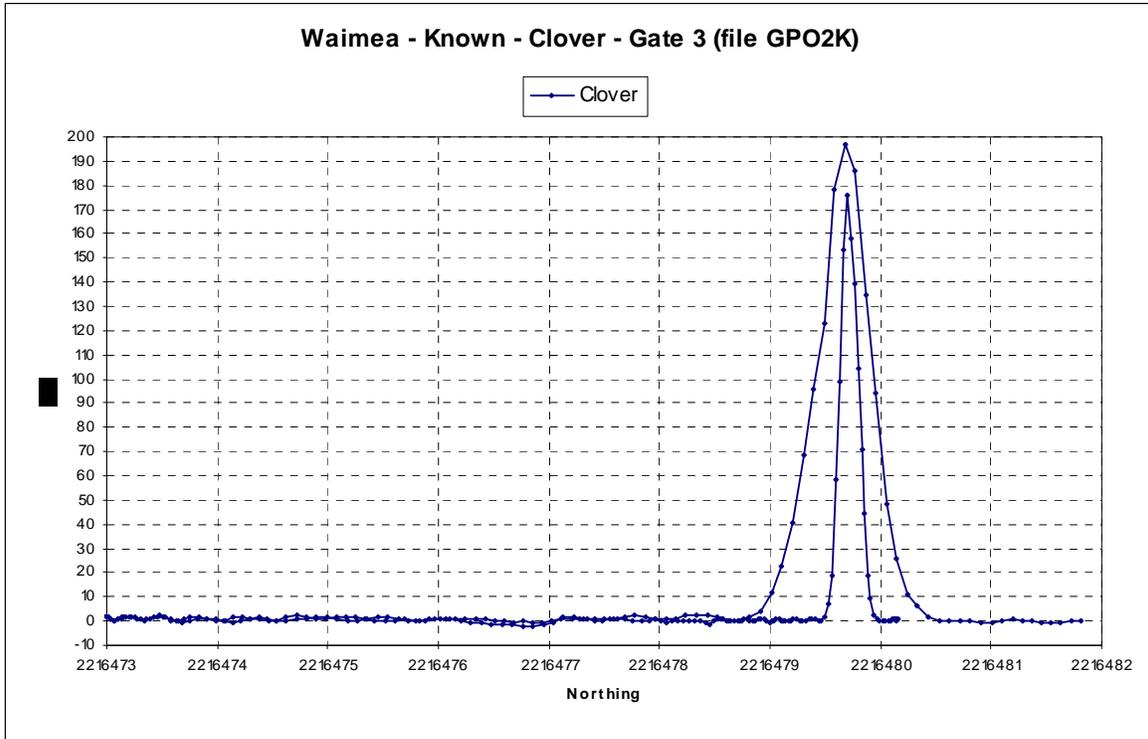
**FIGURE F- 16 WAIKOLOA GPO - CONTRACTORS' GRID CLOVERLEAF TEST RESULTS**



**FIGURE F- 17 WAIKOLOA GPO - KNOWN GRID CLOVERLEAF TEST RESULTS**



**FIGURE F- 18 WAIKOLOA GPO - UNKNOWN GRID CLOVERLEAF TEST RESULTS**



**FIGURE F- 19 WAIMEA GPO - KNOWN GRID CLOVERLEAF TEST RESULTS**

**F.10 INDIVIDUAL DIG SHEETS**

**F.10.1 WAIKOLOA KNOWN GRID – EM61MK2 TIME GATE 1**

(file GPO1K\_Known\_MK2\_Gate1.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO1K-1	207950.00	2205432.60	73.26
2	GPO1K-2	207952.72	2205422.94	71.37
2*	w011*	207952.43*	2205422.92*	Reacquired
3	GPO1K-3	207954.40	2205415.00	67.12
4	GPO1K-4	207964.92	2205434.63	66.01
4*	w053*	207964.74*	2205434.70*	Reacquired
5	GPO1K-5	207957.60	2205416.80	62.13
6	GPO1K-6	207955.84	2205438.36	60.69
6*	w028*	207956.23*	2205437.93*	Reacquired
7	GPO1K-7	207974.99	2205427.16	59.10
8	GPO1K-8	207946.88	2205435.62	57.62
9	GPO1K-9	207955.63	2205423.90	54.56
10	GPO1K-10	207949.27	2205422.53	53.86
11	GPO1K-11	207955.20	2205423.40	53.76
12	GPO1K-12	207949.80	2205423.00	52.97
13	GPO1K-13	207953.01	2205415.28	50.05
14	GPO1K-14	207975.60	2205426.80	47.47
15	GPO1K-15	207959.60	2205433.40	47.06
16	GPO1K-16	207958.40	2205433.60	46.22
17	GPO1K-17	207952.31	2205425.87	45.92
18	GPO1K-18	207950.00	2205438.07	43.96
18*	w002*	207950.30*	2205438.22*	Reacquired
19	GPO1K-19	207953.78	2205429.72	43.83
20	GPO1K-20	207954.11	2205432.93	43.79
21	GPO1K-21	207956.60	2205416.60	41.83
22	GPO1K-22	207951.40	2205415.00	40.59
23	GPO1K-23	207952.40	2205417.00	39.79
24	GPO1K-24	207957.20	2205416.20	39.77
25	GPO1K-25	207951.60	2205434.60	39.44
25*	w051*	207951.20*	2205434.80*	Reacquired
26	GPO1K-26	207962.40	2205435.60	37.40
27	GPO1K-27	207955.20	2205414.32	37.20
28	GPO1K-28	207957.89	2205421.01	33.41
29	GPO1K-29	207949.60	2205440.80	32.19
30	GPO1K-30	207956.20	2205435.20	31.58
31	GPO1K-31	207952.32	2205437.65	31.57
32	GPO1K-32	207962.15	2205439.99	30.78
33	GPO1K-33	207949.20	2205438.80	30.37
34	GPO1K-34	207948.80	2205441.20	30.16

(file GPO1K\_Known\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
35	GPO1K-35	207952.40	2205436.80	30.02
36	GPO1K-36	207947.40	2205429.60	29.47
37	GPO1K-37	207946.80	2205422.20	29.15
38	GPO1K-38	207954.00	2205443.20	29.00
39	GPO1K-39	207951.00	2205437.60	28.55
40	GPO1K-40	207969.50	2205416.77	28.53
41	GPO1K-41	207958.80	2205444.60	28.47
42	GPO1K-42	207946.80	2205442.60	28.26
43	GPO1K-43	207962.80	2205416.20	28.11
44	GPO1K-44	207961.00	2205420.60	26.90
45	GPO1K-45	207951.40	2205419.20	26.49
46	GPO1K-46	207953.63	2205437.13	26.48
47	GPO1K-47	207954.60	2205437.00	25.73
48	GPO1K-48	207957.00	2205421.40	25.56
49	GPO1K-49	207955.00	2205419.40	25.01
50	GPO1K-50	207948.20	2205436.80	24.94
51	GPO1K-51	207950.29	2205439.54	24.58
52	GPO1K-52	207954.00	2205438.00	24.49
53	GPO1K-53	207962.80	2205432.80	23.56
54	GPO1K-54	207946.53	2205438.88	23.46
55	GPO1K-55	207953.40	2205417.20	23.46
56	GPO1K-56	207951.20	2205439.20	23.36
57	GPO1K-57	207947.13	2205439.93	23.25
58	GPO1K-58	207958.87	2205438.14	23.23
59	GPO1K-59	207961.24	2205414.75	23.11
60	GPO1K-60	207948.00	2205426.20	23.00
61	GPO1K-61	207955.20	2205427.80	22.90
62	GPO1K-62	207960.60	2205434.20	22.80
63	GPO1K-63	207951.99	2205440.05	22.75
64	GPO1K-64	207951.85	2205414.46	22.63
65	GPO1K-65	207960.40	2205420.00	22.48
66	GPO1K-66	207945.51	2205434.26	22.32
67	GPO1K-67	207948.00	2205422.00	22.09
68	GPO1K-68	207961.40	2205434.60	21.84
69	GPO1K-69	207953.33	2205439.21	21.80
70	GPO1K-70	207962.40	2205414.60	21.60
71	GPO1K-71	207967.20	2205440.00	21.56
72	GPO1K-72	207950.00	2205428.40	21.38
73	GPO1K-73	207964.80	2205423.60	21.35
74	GPO1K-74	207961.60	2205415.40	21.05
75	GPO1K-75	207945.74	2205440.15	20.97
76	GPO1K-76	207963.84	2205424.49	20.94
77	GPO1K-77	207975.20	2205424.60	20.85
78	GPO1K-78	207946.60	2205427.40	20.84
79	GPO1K-79	207967.50	2205431.11	20.81

(file GPO1K\_Known\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
80	GPO1K-80	207961.40	2205433.60	20.71
81	GPO1K-81	207959.44	2205420.46	20.70
82	GPO1K-82	207944.60	2205441.40	20.68
83	GPO1K-83	207956.80	2205441.80	20.62
84	GPO1K-84	207944.05	2205436.83	20.56
85	GPO1K-85	207946.23	2205440.65	20.36
86	GPO1K-86	207962.40	2205421.20	20.29
87	GPO1K-87	207949.20	2205434.20	20.24
88	GPO1K-88	207960.20	2205442.40	20.19
89	GPO1K-89	207968.20	2205430.20	19.67
90	GPO1K-90	207954.45	2205424.22	19.54
91	GPO1K-91	207958.80	2205424.00	19.45
92	GPO1K-92	207949.66	2205436.31	19.45
93	GPO1K-93	207951.58	2205443.93	19.44
94	GPO1K-94	207954.80	2205430.60	19.42
95	GPO1K-95	207963.28	2205421.21	19.41
96	GPO1K-96	207973.60	2205434.40	19.40
97	GPO1K-97	207965.80	2205436.60	19.40
98	GPO1K-98	207949.60	2205417.60	19.38
99	GPO1K-99	207945.40	2205436.60	19.24
100	GPO1K-100	207955.10	2205443.64	19.12
101	GPO1K-101	207966.00	2205444.80	19.10
102	GPO1K-102	207944.60	2205434.20	19.07
103	GPO1K-103	207960.20	2205443.00	19.07
104	GPO1K-104	207960.40	2205441.65	18.91
105	GPO1K-105	207966.40	2205431.20	18.85
106	GPO1K-106	207956.00	2205441.60	18.75
107	GPO1K-107	207958.80	2205424.60	18.72
108	GPO1K-108	207965.00	2205424.40	18.54
109	GPO1K-109	207955.84	2205419.05	18.53
110	GPO1K-110	207968.00	2205443.20	18.47
111	GPO1K-111	207972.60	2205440.00	18.45
112	GPO1K-112	207971.80	2205445.00	18.44
113	GPO1K-113	207954.09	2205422.44	18.38
114	GPO1K-114	207959.00	2205437.40	18.12
115	GPO1K-115	207950.40	2205441.80	18.09
116	GPO1K-116	207966.80	2205444.00	18.05
117	GPO1K-117	207958.80	2205434.80	18.04
118	GPO1K-118	207953.76	2205425.32	17.99
119	GPO1K-119	207975.00	2205428.60	17.88
120	GPO1K-120	207970.39	2205435.08	17.88
121	GPO1K-121	207953.00	2205436.00	17.84
122	GPO1K-122	207947.80	2205417.40	17.71
123	GPO1K-123	207967.70	2205440.76	17.66
124	GPO1K-124	207951.40	2205428.80	17.64

(file GPO1K\_Known\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
125	GPO1K-125	207968.40	2205440.40	17.59
126	GPO1K-126	207958.00	2205424.20	17.52
127	GPO1K-127	207963.00	2205444.60	17.46
128	GPO1K-128	207963.00	2205414.20	17.44
129	GPO1K-129	207970.60	2205437.40	17.40
130	GPO1K-130	207946.00	2205432.80	17.23
131	GPO1K-131	207970.63	2205435.59	17.18
132	GPO1K-132	207947.51	2205437.82	17.17
133	GPO1K-133	207954.00	2205444.20	17.12
134	GPO1K-134	207957.60	2205444.60	17.09
135	GPO1K-135	207974.00	2205433.60	17.06
136	GPO1K-136	207974.60	2205434.60	17.04
137	GPO1K-137	207972.80	2205435.40	17.04
138	GPO1K-138	207947.80	2205424.00	17.02
139	GPO1K-139	207970.00	2205432.20	16.95
140	GPO1K-140	207971.60	2205440.20	16.94
141	GPO1K-141	207949.60	2205419.80	16.86
142	GPO1K-142	207948.00	2205443.00	16.85
143	GPO1K-143	207954.20	2205426.40	16.84
144	GPO1K-144	207972.80	2205424.20	16.79
145	GPO1K-145	207950.40	2205416.80	16.76
146	GPO1K-146	207953.80	2205440.80	16.74
147	GPO1K-147	207960.60	2205440.20	16.72
148	GPO1K-148	207946.60	2205429.40	16.68
149	GPO1K-149	207959.40	2205440.60	16.66
150	GPO1K-150	207962.46	2205424.61	16.65
151	GPO1K-151	207949.00	2205424.20	16.46
152	GPO1K-152	207945.53	2205435.81	16.44
153	GPO1K-153	207963.20	2205433.60	16.37
154	GPO1K-154	207958.20	2205432.40	16.30
155	GPO1K-155	207954.00	2205418.40	16.24
156	GPO1K-156	207952.20	2205420.20	16.23
157	GPO1K-157	207946.08	2205441.62	16.16
158	GPO1K-158	207964.80	2205415.20	16.06
159	GPO1K-159	207972.00	2205438.00	16.05
160	GPO1K-160	207965.99	2205417.49	16.02
161	GPO1K-161	207969.80	2205436.20	15.96
162	GPO1K-162	207971.80	2205439.60	15.95
163	GPO1K-163	207949.40	2205427.60	15.73
164	GPO1K-164	207967.60	2205424.60	15.69
165	GPO1K-165	207957.40	2205424.60	15.68
166	GPO1K-166	207967.00	2205422.00	15.59
167	GPO1K-167	207964.00	2205441.00	15.55
168	GPO1K-168	207969.02	2205435.08	15.44
169	GPO1K-169	207972.20	2205436.20	15.43

(file GPO1K\_Known\_MK2\_Gate1.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
170	GPO1K-170	207964.20	2205414.60	15.42
171	GPO1K-171	207960.00	2205440.00	15.39
172	GPO1K-172	207970.00	2205445.20	15.39
173	GPO1K-173	207953.10	2205420.35	15.37
174	GPO1K-174	207963.60	2205415.40	15.37
175	GPO1K-175	207966.40	2205432.00	15.35
176	GPO1K-176	207971.60	2205423.60	15.33
177	GPO1K-177	207967.60	2205441.40	15.25
178	GPO1K-178	207947.00	2205433.80	15.18
179	GPO1K-179	207968.00	2205442.60	15.15
180	GPO1K-180	207972.20	2205428.00	15.09
181	GPO1K-181	207973.78	2205441.90	15.00

**F.10.2 WAIKOLOA KNOWN GRID – EM61MK2 TIME GATE 2**

(file GPO1K\_Known\_MK2\_Gate2.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO1K-1	207949.95	2205432.60	49.83
2	GPO1K-2	207952.76	2205422.93	47.31
2*	w011*	207952.43*	2205422.92*	Reacquired
3	GPO1K-3	207964.93	2205434.65	45.73
3*	w053*	207964.74*	2205434.70*	Reacquired
4	GPO1K-4	207974.98	2205427.17	41.12
5	GPO1K-5	207954.40	2205415.00	40.57
6	GPO1K-6	207957.60	2205416.80	40.25
7	GPO1K-7	207956.00	2205438.40	37.94
7*	w028*	207956.23*	2205437.93*	Reacquired
8	GPO1K-8	207946.84	2205435.61	36.93
9	GPO1K-9	207953.00	2205415.40	35.79
10	GPO1K-10	207949.80	2205423.00	34.37
11	GPO1K-11	207949.26	2205422.54	34.34
12	GPO1K-12	207955.64	2205423.91	33.93
13	GPO1K-13	207955.20	2205423.40	32.83
14	GPO1K-14	207975.60	2205426.80	29.52
15	GPO1K-15	207952.31	2205425.84	28.67
16	GPO1K-16	207950.03	2205438.09	28.06
16*	w002*	207950.30*	2205438.22*	Reacquired
17	GPO1K-17	207958.39	2205433.62	27.32
18	GPO1K-18	207953.76	2205429.68	27.18
19	GPO1K-19	207954.13	2205432.91	27.10
20	GPO1K-20	207959.62	2205433.37	26.64
21	GPO1K-21	207956.66	2205416.59	26.48

(file GPO1K_Known_MK2_Gate2.xls)				
Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
22	GPO1K-22	207951.36	2205415.03	25.85
23	GPO1K-23	207957.80	2205421.00	25.34
24	GPO1K-24	207952.40	2205417.00	25.22
25	GPO1K-25	207951.53	2205434.70	25.13
25*	w051*	207951.20*	2205434.80*	Reacquired
26	GPO1K-26	207957.20	2205416.14	23.99
27	GPO1K-27	207955.20	2205414.20	23.24
28	GPO1K-28	207953.40	2205417.20	20.91
29	GPO1K-29	207952.31	2205437.66	20.39
30	GPO1K-30	207952.40	2205436.80	20.00
31	GPO1K-31	207962.14	2205440.03	19.34
32	GPO1K-32	207956.20	2205435.20	18.99
33	GPO1K-33	207947.44	2205429.59	18.91
34	GPO1K-34	207946.80	2205422.20	18.83
35	GPO1K-35	207949.67	2205440.71	18.76
36	GPO1K-36	207954.00	2205443.20	18.69
37	GPO1K-37	207958.80	2205444.60	18.59
38	GPO1K-38	207962.40	2205435.60	18.46
39	GPO1K-39	207953.60	2205437.40	18.22
40	GPO1K-40	207961.00	2205420.60	18.03
41	GPO1K-41	207969.51	2205416.78	18.01
42	GPO1K-42	207951.20	2205439.20	17.59
43	GPO1K-43	207958.80	2205438.20	17.51
44	GPO1K-44	207948.80	2205441.20	17.45
45	GPO1K-45	207948.20	2205436.80	17.04
46	GPO1K-46	207949.20	2205438.80	16.68
47	GPO1K-47	207946.80	2205442.60	16.49
48	GPO1K-48	207960.70	2205434.20	16.12
49	GPO1K-49	207945.40	2205434.20	16.01
50	GPO1K-50	207951.40	2205419.20	15.99
51	GPO1K-51	207975.30	2205424.58	15.93
52	GPO1K-52	207948.00	2205422.00	15.73
53	GPO1K-53	207955.00	2205419.40	15.62
54	GPO1K-54	207955.40	2205427.84	15.22
55	GPO1K-55	207965.40	2205436.60	15.14
56	GPO1K-56	207954.80	2205430.60	15.00
57	GPO1K-57	207962.80	2205416.20	14.98
58	GPO1K-58	207949.20	2205434.20	14.96
59	GPO1K-59	207963.78	2205424.46	14.92
60	GPO1K-60	207946.60	2205427.60	14.85
61	GPO1K-61	207951.95	2205439.98	14.81
62	GPO1K-62	207951.83	2205414.38	14.74
63	GPO1K-63	207953.70	2205436.70	14.64
64	GPO1K-64	207962.80	2205432.80	14.58
65	GPO1K-65	207960.40	2205420.20	14.29

(file GPO1K\_Known\_MK2\_Gate2.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
66	GPO1K-66	207946.44	2205434.96	14.12
67	GPO1K-67	207954.80	2205436.40	14.01
68	GPO1K-68	207956.80	2205441.80	13.98
69	GPO1K-69	207951.00	2205437.55	13.92
70	GPO1K-70	207948.00	2205426.20	13.90
71	GPO1K-71	207950.00	2205428.40	13.85
72	GPO1K-72	207950.23	2205439.73	13.54
73	GPO1K-73	207972.79	2205440.13	13.41
74	GPO1K-74	207963.40	2205421.20	13.40
75	GPO1K-75	207954.00	2205438.00	13.38
76	GPO1K-76	207967.20	2205440.00	13.37
77	GPO1K-77	207959.60	2205420.34	13.35
78	GPO1K-78	207964.69	2205423.64	13.28
79	GPO1K-79	207954.72	2205437.27	13.17
80	GPO1K-80	207953.30	2205439.24	13.16
81	GPO1K-81	207971.80	2205445.00	13.14
82	GPO1K-82	207961.19	2205439.65	13.11
83	GPO1K-83	207959.00	2205437.40	13.08
84	GPO1K-84	207947.20	2205440.00	13.07
85	GPO1K-85	207945.82	2205440.54	13.01
86	GPO1K-86	207953.60	2205425.40	12.98
87	GPO1K-87	207949.40	2205427.60	12.84
88	GPO1K-88	207966.00	2205444.80	12.80
89	GPO1K-89	207953.00	2205420.20	12.60
90	GPO1K-90	207959.41	2205443.48	12.47
91	GPO1K-91	207945.69	2205439.95	12.40
92	GPO1K-92	207960.60	2205414.80	12.35
93	GPO1K-93	207958.00	2205424.20	12.30
94	GPO1K-94	207962.40	2205414.60	12.24
95	GPO1K-95	207954.44	2205424.15	12.15
96	GPO1K-96	207952.32	2205420.37	12.11
97	GPO1K-97	207959.20	2205440.80	12.03
98	GPO1K-98	207968.20	2205430.20	11.99
99	GPO1K-99	207955.78	2205418.96	11.98
100	GPO1K-100	207949.80	2205417.40	11.77
101	GPO1K-101	207944.20	2205436.80	11.73
102	GPO1K-102	207946.40	2205438.80	11.55
103	GPO1K-103	207957.60	2205444.60	11.42
104	GPO1K-104	207970.29	2205435.05	11.37
105	GPO1K-105	207951.20	2205441.40	11.36
106	GPO1K-106	207960.27	2205442.57	11.34
107	GPO1K-107	207946.80	2205423.00	11.33
108	GPO1K-108	207946.00	2205437.20	11.32
109	GPO1K-109	207950.19	2205414.69	11.24
110	GPO1K-110	207973.40	2205434.40	11.19

(file GPO1K\_Known\_MK2\_Gate2.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
111	GPO1K-111	207946.22	2205441.14	11.14
112	GPO1K-112	207951.40	2205428.80	11.14
113	GPO1K-113	207960.40	2205441.80	11.13
114	GPO1K-114	207961.69	2205433.18	11.11
115	GPO1K-115	207965.00	2205424.40	11.10
116	GPO1K-116	207958.20	2205432.40	11.07
117	GPO1K-117	207967.51	2205431.10	11.02
118	GPO1K-118	207955.20	2205443.60	10.95
119	GPO1K-119	207962.53	2205424.71	10.94
120	GPO1K-120	207958.80	2205435.00	10.94
121	GPO1K-121	207962.40	2205421.20	10.85
122	GPO1K-122	207959.80	2205440.00	10.83
123	GPO1K-123	207966.00	2205417.40	10.78
124	GPO1K-124	207945.40	2205429.20	10.78
125	GPO1K-125	207961.52	2205414.97	10.73
126	GPO1K-126	207962.60	2205442.80	10.72
127	GPO1K-127	207947.00	2205433.80	10.67
128	GPO1K-128	207966.40	2205442.00	10.64
129	GPO1K-129	207971.60	2205423.60	10.62
130	GPO1K-130	207969.60	2205429.00	10.61
131	GPO1K-131	207964.20	2205414.80	10.60
132	GPO1K-132	207944.60	2205441.40	10.59
133	GPO1K-133	207970.60	2205437.40	10.52
134	GPO1K-134	207967.60	2205424.60	10.47
135	GPO1K-135	207963.91	2205416.16	10.46
136	GPO1K-136	207966.21	2205431.23	10.43
137	GPO1K-137	207947.80	2205424.00	10.40
138	GPO1K-138	207971.60	2205440.20	10.37
139	GPO1K-139	207972.80	2205424.20	10.36
140	GPO1K-140	207974.60	2205434.60	10.33
141	GPO1K-141	207968.99	2205415.66	10.24
142	GPO1K-142	207963.00	2205444.60	10.20
143	GPO1K-143	207947.80	2205443.20	10.19
144	GPO1K-144	207968.00	2205443.20	10.16
145	GPO1K-145	207945.40	2205436.00	10.15
146	GPO1K-146	207948.40	2205417.40	10.07
147	GPO1K-147	207947.60	2205417.40	10.04
148	GPO1K-148	207969.80	2205443.20	10.00

**F.10.3 WAIKOLOA KNOWN GRID – EM61MK2 TIME GATE 3**

(file GPO1K\_Known\_MK2\_Gate3.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
1	GPO1K-1	207950.00	2205432.57	31.31

(file GPO1K\_Known\_MK2\_Gate3.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
2	GPO1K-2	207964.92	2205434.64	28.51
2*	w053*	207964.74*	2205434.70*	Reacquired
3	GPO1K-3	207952.77	2205422.90	26.13
3*	w011*	207952.43*	2205422.92*	Reacquired
4	GPO1K-4	207975.00	2205427.20	24.38
5	GPO1K-5	207954.40	2205415.00	23.15
6	GPO1K-6	207957.71	2205416.88	22.16
7	GPO1K-7	207955.60	2205423.80	21.37
8	GPO1K-8	207955.91	2205438.33	21.08
8*	w028*	207956.23*	2205437.93*	Reacquired
9	GPO1K-9	207949.20	2205422.47	20.78
10	GPO1K-10	207946.93	2205435.57	20.29
11	GPO1K-11	207953.02	2205415.31	20.10
12	GPO1K-12	207949.88	2205422.98	19.03
13	GPO1K-13	207950.00	2205438.20	17.72
13*	w002*	207950.30*	2205438.22*	Reacquired
14	GPO1K-14	207975.60	2205426.80	16.57
15	GPO1K-15	207952.23	2205425.92	15.77
16	GPO1K-16	207951.40	2205415.00	15.53
17	GPO1K-17	207954.11	2205432.92	15.38
18	GPO1K-18	207951.48	2205434.67	15.33
18*	w051*	207951.20*	2205434.80*	Reacquired
19	GPO1K-19	207953.76	2205429.65	15.28
20	GPO1K-20	207956.70	2205416.46	14.72
21	GPO1K-21	207952.40	2205417.00	13.88
22	GPO1K-22	207958.40	2205433.60	13.73
23	GPO1K-23	207949.60	2205440.80	13.33
24	GPO1K-24	207959.60	2205433.40	12.81
25	GPO1K-25	207952.34	2205437.38	12.10
26	GPO1K-26	207946.80	2205422.40	11.61
27	GPO1K-27	207957.96	2205420.98	10.96
28	GPO1K-28	207961.00	2205420.60	10.92
29	GPO1K-29	207962.08	2205440.01	10.56
30	GPO1K-30	207947.40	2205429.60	10.32
31	GPO1K-31	207954.00	2205443.20	10.06
32	GPO1K-32	207949.17	2205438.91	10.02
33	GPO1K-33	207946.80	2205442.60	10.01
34	GPO1K-34	207962.80	2205416.20	9.81
35	GPO1K-35	207953.60	2205437.40	9.75
36	GPO1K-36	207962.40	2205435.60	9.68
37	GPO1K-37	207969.49	2205416.78	9.36
38	GPO1K-38	207957.20	2205421.20	9.35
39	GPO1K-39	207956.20	2205435.20	9.25

(file GPO1K\_Known\_MK2\_Gate3.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
40	GPO1K-40	207951.40	2205419.20	9.09
41	GPO1K-41	207958.80	2205444.60	8.94
42	GPO1K-42	207953.40	2205417.20	8.83
43	GPO1K-43	207948.20	2205436.80	8.76
44	GPO1K-44	207960.37	2205420.09	8.70
45	GPO1K-45	207947.20	2205440.00	8.62
46	GPO1K-46	207948.20	2205422.00	8.59
47	GPO1K-47	207955.00	2205419.20	8.56
48	GPO1K-48	207950.36	2205439.51	8.55
49	GPO1K-49	207951.02	2205437.40	8.52
50	GPO1K-50	207951.20	2205439.00	8.29
51	GPO1K-51	207952.00	2205440.00	8.15
52	GPO1K-52	207958.80	2205438.20	8.15
53	GPO1K-53	207945.40	2205434.20	8.09
54	GPO1K-54	207950.60	2205414.60	7.96
55	GPO1K-55	207954.00	2205438.00	7.91
56	GPO1K-56	207954.54	2205436.58	7.84
57	GPO1K-57	207950.00	2205428.40	7.82
58	GPO1K-58	207946.53	2205438.79	7.68
59	GPO1K-59	207962.80	2205432.80	7.56
60	GPO1K-60	207960.40	2205442.60	7.41
61	GPO1K-61	207954.53	2205424.12	7.39
62	GPO1K-62	207960.82	2205434.07	7.32
63	GPO1K-63	207946.60	2205427.60	7.29
64	GPO1K-64	207953.40	2205439.20	7.02
65	GPO1K-65	207963.20	2205421.40	7.02
66	GPO1K-66	207961.20	2205414.80	6.94
67	GPO1K-67	207967.20	2205440.00	6.93
68	GPO1K-68	207955.34	2205427.85	6.93
69	GPO1K-69	207968.20	2205430.20	6.90
70	GPO1K-70	207949.60	2205417.60	6.85
71	GPO1K-71	207965.80	2205436.60	6.82
72	GPO1K-72	207952.75	2205438.26	6.79
73	GPO1K-73	207964.80	2205423.60	6.79
74	GPO1K-74	207955.20	2205443.60	6.74
75	GPO1K-75	207967.60	2205431.20	6.64
76	GPO1K-76	207952.93	2205420.40	6.63
77	GPO1K-77	207959.40	2205443.40	6.59
78	GPO1K-78	207961.10	2205439.56	6.58
79	GPO1K-79	207946.00	2205433.00	6.53
80	GPO1K-80	207949.20	2205434.40	6.51
81	GPO1K-81	207944.40	2205436.60	6.50
82	GPO1K-82	207959.00	2205437.40	6.48
83	GPO1K-83	207963.80	2205424.40	6.48
84	GPO1K-84	207946.96	2205433.80	6.45

(file GPO1K\_Known\_MK2\_Gate3.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
85	GPO1K-85	207963.00	2205414.20	6.43
86	GPO1K-86	207953.04	2205435.99	6.43
87	GPO1K-87	207947.84	2205426.18	6.42
88	GPO1K-88	207944.60	2205441.40	6.41
89	GPO1K-89	207946.18	2205440.76	6.39
90	GPO1K-90	207945.80	2205440.00	6.39
91	GPO1K-91	207947.51	2205437.82	6.38
92	GPO1K-92	207949.53	2205419.87	6.36
93	GPO1K-93	207950.43	2205441.97	6.32
94	GPO1K-94	207975.00	2205428.60	6.30
95	GPO1K-95	207966.00	2205444.80	6.29
96	GPO1K-96	207960.40	2205441.80	6.21
97	GPO1K-97	207958.80	2205424.00	6.21
98	GPO1K-98	207970.60	2205435.60	6.18
99	GPO1K-99	207945.40	2205436.20	6.17
100	GPO1K-100	207965.00	2205424.40	6.17
101	GPO1K-101	207953.80	2205425.40	6.10
102	GPO1K-102	207971.80	2205445.00	6.10
103	GPO1K-103	207945.40	2205434.80	6.09
104	GPO1K-104	207964.00	2205416.20	6.02
105	GPO1K-105	207961.60	2205433.20	6.00

**F.10.4 WAIKOLOA UNKNOWN GRID – EM61MK2 TIME GATE 1**

(file GPO1\_Unknown\_MK2\_Gate1.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO1U-1	207985.06	2205418.14	155.89
1*	GPO1U-1*	207984.94*	2205417.86*	Reacquired
2	GPO1U-2	207977.57	2205421.87	54.76
3	GPO1U-3	208002.60	2205428.40	48.17
3*	GPO1U-3*	208002.58*	2205428.43*	Reacquired
4	GPO1U-4	207978.00	2205447.00	45.38
5	GPO1U-5	207978.78	2205424.43	43.42
5*	GPO1U-5*	207978.50*	2205424.37*	Reacquired
6	GPO1U-6	207977.40	2205422.60	42.51
7	GPO1U-7	207976.38	2205425.17	42.46
8	GPO1U-8	207975.59	2205427.19	40.99
9	GPO1U-9	208003.20	2205437.00	39.79
10	GPO1U-10	207977.40	2205433.80	37.19
11	GPO1U-11	208005.85	2205435.51	37.03
12	GPO1U-12	207985.81	2205422.00	36.76
13	GPO1U-13	208004.25	2205428.40	35.85
14	GPO1U-14	207976.60	2205427.80	35.29

(file GPO1\_Unknown\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
15	GPO1U-15	207987.20	2205441.60	31.47
16	GPO1U-16	207987.80	2205441.40	31.03
17	GPO1U-17	207976.25	2205422.98	29.74
18	GPO1U-18	207976.40	2205422.40	29.41
19	GPO1U-19	208000.60	2205432.00	29.09
20	GPO1U-20	207977.79	2205424.62	28.76
21	GPO1U-21	208004.00	2205434.20	28.73
22	GPO1U-22	208002.13	2205436.60	28.68
23	GPO1U-23	208001.40	2205434.80	27.75
24	GPO1U-24	208004.66	2205424.61	27.39
25	GPO1U-25	207980.40	2205427.80	26.42
26	GPO1U-26	207975.40	2205441.60	25.99
27	GPO1U-27	207987.60	2205435.60	25.96
28	GPO1U-28	207986.40	2205435.60	25.87
29	GPO1U-29	207987.00	2205435.80	25.30
30	GPO1U-30	207992.05	2205443.00	25.04
31	GPO1U-31	207978.80	2205425.40	25.02
32	GPO1U-32	207998.80	2205433.60	24.91
33	GPO1U-33	208004.16	2205424.22	24.37
34	GPO1U-34	207989.45	2205425.44	24.33
35	GPO1U-35	208005.12	2205430.28	23.60
36	GPO1U-36	207981.29	2205446.69	23.28
37	GPO1U-37	208005.20	2205424.00	22.99
38	GPO1U-38	207975.60	2205440.40	22.98
39	GPO1U-39	208006.00	2205434.80	22.80
40	GPO1U-40	208004.60	2205421.60	22.62
41	GPO1U-41	207998.00	2205420.45	22.53
42	GPO1U-42	207980.00	2205437.20	22.22
43	GPO1U-43	207983.94	2205448.31	21.44
44	GPO1U-44	207983.63	2205422.05	21.39
45	GPO1U-45	207979.00	2205435.24	21.19
46	GPO1U-46	207993.96	2205424.40	20.98
47	GPO1U-47	207989.73	2205440.66	20.75
48	GPO1U-48	207995.20	2205441.20	20.54
49	GPO1U-49	207990.03	2205425.92	20.24
50	GPO1U-50	207997.00	2205431.20	20.08
51	GPO1U-51	208005.80	2205433.00	20.03
52	GPO1U-52	207996.60	2205430.00	19.96
53	GPO1U-53	207992.40	2205427.00	19.90
54	GPO1U-54	207980.20	2205444.00	19.82
55	GPO1U-55	207977.40	2205441.20	19.81
56	GPO1U-56	207982.40	2205444.20	19.78
57	GPO1U-57	208005.60	2205424.80	19.73
58	GPO1U-58	207984.60	2205448.60	19.72

(file GPO1\_Unknown\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
59	GPO1U-59	207979.93	2205447.98	19.30
60	GPO1U-60	207991.80	2205440.00	19.22
61	GPO1U-61	207992.40	2205426.40	19.12
62	GPO1U-62	208000.60	2205449.40	19.05
63	GPO1U-63	208000.60	2205440.80	19.04
64	GPO1U-64	207984.40	2205432.60	18.95
65	GPO1U-65	207996.68	2205430.49	18.94
66	GPO1U-66	208002.00	2205441.00	18.93
67	GPO1U-67	207988.60	2205447.40	18.89
68	GPO1U-68	207975.00	2205440.60	18.88
69	GPO1U-69	207999.40	2205449.00	18.80
70	GPO1U-70	207974.80	2205442.40	18.79
71	GPO1U-71	208001.69	2205448.60	18.74
72	GPO1U-72	207988.40	2205442.20	18.71
73	GPO1U-73	207981.40	2205436.20	18.57
74	GPO1U-74	207989.40	2205424.80	18.46
75	GPO1U-75	207988.60	2205440.60	18.40
76	GPO1U-76	207993.60	2205426.44	18.39
77	GPO1U-77	207977.40	2205444.40	18.36
78	GPO1U-78	208005.95	2205432.54	18.33
79	GPO1U-79	207981.14	2205436.75	18.23
80	GPO1U-80	207994.62	2205441.72	18.15
81	GPO1U-81	208003.65	2205434.84	18.11
82	GPO1U-82	207981.99	2205436.04	18.00
83	GPO1U-83	207981.04	2205433.51	17.96
84	GPO1U-84	208001.90	2205431.72	17.90
85	GPO1U-85	207983.40	2205417.80	17.90
86	GPO1U-86	208004.40	2205434.60	17.87
87	GPO1U-87	207981.60	2205427.40	17.86
88	GPO1U-88	207996.99	2205441.65	17.76
89	GPO1U-89	207991.03	2205440.47	17.65
90	GPO1U-90	207984.20	2205422.80	17.41
91	GPO1U-91	207997.00	2205441.20	17.37
92	GPO1U-92	207998.20	2205421.20	17.31
93	GPO1U-93	207997.80	2205429.80	17.28
94	GPO1U-94	208005.80	2205430.00	17.24
95	GPO1U-95	207980.00	2205434.00	17.24
96	GPO1U-96	208002.40	2205448.60	17.14
97	GPO1U-97	207994.00	2205428.20	17.09
98	GPO1U-98	207976.97	2205447.19	17.09
99	GPO1U-99	207974.80	2205434.40	17.04
100	GPO1U-100	207980.40	2205433.60	17.04
101	GPO1U-101	207980.40	2205424.80	16.97
102	GPO1U-102	207974.00	2205442.20	16.97
103	GPO1U-103	207981.45	2205428.15	16.96

(file GPO1\_Unknown\_MK2\_Gate1.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
104	GPO1U-104	208003.60	2205423.61	16.83
105	GPO1U-105	207991.00	2205430.00	16.83
106	GPO1U-106	207983.40	2205427.60	16.80
107	GPO1U-107	207999.00	2205420.80	16.79
108	GPO1U-108	208002.60	2205431.80	16.75
109	GPO1U-109	207982.80	2205436.00	16.75
110	GPO1U-110	207991.80	2205432.40	16.70
111	GPO1U-111	207996.80	2205435.40	16.64
112	GPO1U-112	207988.60	2205426.80	16.63
113	GPO1U-113	207996.60	2205422.00	16.51
114	GPO1U-114	207993.80	2205428.80	16.50
115	GPO1U-115	207992.80	2205424.00	16.40
116	GPO1U-116	207983.88	2205428.14	16.31
117	GPO1U-117	207997.80	2205430.40	16.29
118	GPO1U-118	207983.40	2205444.80	16.20
119	GPO1U-119	207980.20	2205425.60	16.18
120	GPO1U-120	207984.00	2205445.40	16.02
121	GPO1U-121	208002.86	2205434.61	16.01
122	GPO1U-122	207989.00	2205442.00	15.97
123	GPO1U-123	207995.80	2205441.60	15.85
124	GPO1U-124	207992.00	2205436.20	15.85
125	GPO1U-125	207985.80	2205440.20	15.80
126	GPO1U-126	207985.00	2205440.40	15.80
127	GPO1U-127	207980.60	2205419.80	15.66
128	GPO1U-128	207984.60	2205435.60	15.62
129	GPO1U-129	207993.40	2205427.40	15.57
130	GPO1U-130	208006.40	2205427.00	15.55
131	GPO1U-131	207999.60	2205440.40	15.43
132	GPO1U-132	207982.20	2205420.40	15.43
133	GPO1U-133	208002.20	2205435.60	15.42
134	GPO1U-134	207997.20	2205436.60	15.37
135	GPO1U-135	207981.60	2205420.00	15.29
136	GPO1U-136	207982.60	2205448.60	15.22
137	GPO1U-137	207986.80	2205425.00	15.15
138	GPO1U-138	207976.60	2205444.80	15.08
139	GPO1U-139	207988.20	2205446.60	15.02

**F.10.5 WAIKOLOA UNKNOWN GRID – EM61MK2 TIME GATE 2**

(file GPO1\_Unknown\_MK2\_Gate2.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO1U-1	207985.06	2205418.14	114.93
1*	GPO1U-1*	207984.94*	2205417.86*	Reacquired
2	GPO1U-2	207978.01	2205447.02	28.86

(file GPO1\_Unknown\_MK2\_Gate2.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
3	GPO1U-3	208002.60	2205428.40	28.76
3*	GPO1U-3*	208002.58*	2205428.43*	Reacquired
4	GPO1U-4	207978.79	2205424.44	27.64
4*	GPO1U-4*	207978.50*	2205424.37*	Reacquired
5	GPO1U-5	207977.47	2205422.54	26.48
6	GPO1U-6	207976.40	2205425.15	26.21
7	GPO1U-7	208003.35	2205437.13	24.80
8	GPO1U-8	207975.60	2205427.21	24.33
9	GPO1U-9	207977.40	2205433.93	22.43
10	GPO1U-10	207985.81	2205421.99	22.34
11	GPO1U-11	208004.33	2205428.37	22.00
12	GPO1U-12	207976.66	2205427.71	21.83
13	GPO1U-13	208005.97	2205435.55	21.37
14	GPO1U-14	207987.80	2205441.40	19.76
15	GPO1U-15	208000.60	2205432.00	19.72
16	GPO1U-16	207987.22	2205441.52	19.53
17	GPO1U-17	207977.80	2205424.60	19.03
18	GPO1U-18	208002.27	2205436.67	18.29
19	GPO1U-19	208001.40	2205434.80	17.93
20	GPO1U-20	208004.60	2205424.60	16.46
21	GPO1U-21	208003.97	2205434.32	16.22
22	GPO1U-22	207992.04	2205443.00	16.16
23	GPO1U-23	207987.60	2205435.60	16.12
24	GPO1U-24	207981.22	2205446.66	16.11
25	GPO1U-25	207989.42	2205425.42	16.10
26	GPO1U-26	207978.80	2205425.40	16.01
27	GPO1U-27	207975.40	2205441.63	15.91
28	GPO1U-28	207980.40	2205427.80	15.67
29	GPO1U-29	207998.80	2205433.60	15.52
30	GPO1U-30	207976.41	2205422.67	15.26
31	GPO1U-31	208005.22	2205423.95	15.04
32	GPO1U-32	208004.15	2205424.14	14.67
33	GPO1U-33	208006.00	2205434.80	14.51
34	GPO1U-34	207983.60	2205422.00	14.26
35	GPO1U-35	207986.69	2205435.82	14.20
36	GPO1U-36	207990.00	2205426.00	14.10
37	GPO1U-37	208005.00	2205430.20	13.74
38	GPO1U-38	207979.95	2205437.25	13.61
39	GPO1U-39	207975.59	2205440.40	13.61
40	GPO1U-40	207994.00	2205424.40	13.59
41	GPO1U-41	207989.77	2205440.66	13.55
42	GPO1U-42	207997.99	2205420.45	13.55
43	GPO1U-43	207995.16	2205441.18	12.65

(file GPO1\_Unknown\_MK2\_Gate2.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
44	GPO1U-44	207996.62	2205430.22	12.62
45	GPO1U-45	208005.60	2205424.80	12.61
46	GPO1U-46	207992.40	2205426.40	12.58
47	GPO1U-47	207979.00	2205435.20	12.58
48	GPO1U-48	207983.89	2205448.29	12.52
49	GPO1U-49	207997.00	2205431.20	12.36
50	GPO1U-50	207991.76	2205440.02	12.22
51	GPO1U-51	208000.76	2205440.70	12.16
52	GPO1U-52	207999.40	2205449.00	12.15
53	GPO1U-53	207998.20	2205421.20	12.12
54	GPO1U-54	207996.60	2205422.00	12.07
55	GPO1U-55	207988.60	2205447.40	12.07
56	GPO1U-56	208002.35	2205431.71	11.95
57	GPO1U-57	207974.80	2205442.40	11.95
58	GPO1U-58	208002.00	2205441.00	11.94
59	GPO1U-59	207992.60	2205427.06	11.86
60	GPO1U-60	208001.69	2205448.52	11.85
61	GPO1U-61	208004.60	2205421.60	11.75
62	GPO1U-62	207981.00	2205433.60	11.74
63	GPO1U-63	207982.40	2205444.20	11.71
64	GPO1U-64	207983.40	2205417.80	11.67
65	GPO1U-65	207988.40	2205442.40	11.67
66	GPO1U-66	207984.40	2205432.60	11.66
67	GPO1U-67	208000.81	2205449.30	11.64
68	GPO1U-68	207980.20	2205444.00	11.55
69	GPO1U-69	207997.10	2205441.58	11.43
70	GPO1U-70	207979.89	2205448.00	11.32
71	GPO1U-71	207984.60	2205448.60	11.31
72	GPO1U-72	207997.80	2205429.60	11.31
73	GPO1U-73	207994.00	2205428.20	11.26
74	GPO1U-74	207991.07	2205440.49	11.09
75	GPO1U-75	207994.62	2205441.63	11.05
76	GPO1U-76	207981.60	2205427.40	11.02
77	GPO1U-77	207989.00	2205442.00	11.01
78	GPO1U-78	207993.60	2205426.40	10.94
79	GPO1U-79	207998.88	2205420.61	10.86
80	GPO1U-80	207999.00	2205430.00	10.83
81	GPO1U-81	207988.62	2205440.73	10.82
82	GPO1U-82	207989.40	2205424.80	10.75
83	GPO1U-83	207975.00	2205440.60	10.74
84	GPO1U-84	207977.07	2205447.17	10.70
85	GPO1U-85	207977.40	2205441.00	10.67
86	GPO1U-86	208002.40	2205448.60	10.58
87	GPO1U-87	207980.01	2205433.83	10.50
88	GPO1U-88	207991.80	2205432.40	10.46

(file GPO1\_Unknown\_MK2\_Gate2.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
89	GPO1U-89	208005.85	2205432.82	10.42
90	GPO1U-90	207984.20	2205422.80	10.39
91	GPO1U-91	207997.20	2205436.60	10.31
92	GPO1U-92	207982.00	2205436.00	10.29
93	GPO1U-93	207982.80	2205436.00	10.27
94	GPO1U-94	207996.80	2205435.40	10.27
95	GPO1U-95	207991.00	2205430.00	10.25
96	GPO1U-96	207993.80	2205428.80	10.24
97	GPO1U-97	207981.45	2205428.13	10.21
98	GPO1U-98	207996.40	2205441.20	10.17
99	GPO1U-99	207980.40	2205424.80	10.15
100	GPO1U-100	207997.80	2205430.40	10.13
101	GPO1U-101	207981.32	2205436.44	10.12
102	GPO1U-102	207977.40	2205444.40	10.11
103	GPO1U-103	207993.40	2205427.60	10.00
104	GPO1U-104	207999.61	2205440.56	10.00

**F.10.6 WAIKOLOA UNKNOWN GRID – EM61MK2 TIME GATE 3**

(file GPO1\_Unknown\_MK2\_Gate3.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO1U-1	207985.06	2205418.15	76.42
1*	GPO1U-1*	207984.94*	2205417.86*	Reacquired
2	GPO1U-2	207977.99	2205447.10	16.20
3	GPO1U-3	207977.40	2205422.60	16.08
4	GPO1U-4	207978.73	2205424.46	15.58
4*	GPO1U-4*	207978.50*	2205424.37*	Reacquired
5	GPO1U-5	207976.39	2205425.16	14.63
6	GPO1U-6	207977.40	2205433.80	14.61
7	GPO1U-7	207985.80	2205422.00	14.02
8	GPO1U-8	208004.31	2205428.39	13.89
9	GPO1U-9	207975.60	2205427.26	13.60
10	GPO1U-10	208003.26	2205437.08	12.73
11	GPO1U-11	208005.89	2205435.54	12.64
12	GPO1U-12	207976.60	2205427.72	12.13
13	GPO1U-13	207987.20	2205441.40	11.40
14	GPO1U-14	208002.61	2205428.51	11.19
14*	GPO1U-14*	208002.58*	2205428.43*	Reacquired
15	GPO1U-15	208001.40	2205434.80	11.18
16	GPO1U-16	208000.60	2205432.05	11.14
17	GPO1U-17	207987.88	2205441.56	10.08
18	GPO1U-18	207978.80	2205425.20	9.93
19	GPO1U-19	208002.21	2205436.71	9.86

(file GPO1\_Unknown\_MK2\_Gate3.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
20	GPO1U-20	207980.40	2205427.80	9.53
21	GPO1U-21	207987.53	2205435.72	9.42
22	GPO1U-22	208004.60	2205424.60	9.30
23	GPO1U-23	208002.60	2205431.80	9.13
24	GPO1U-24	207981.22	2205446.64	9.10
25	GPO1U-25	207983.60	2205422.00	8.94
26	GPO1U-26	207986.42	2205435.72	8.76
27	GPO1U-27	207975.35	2205441.72	8.69
28	GPO1U-28	207998.97	2205433.61	8.64
29	GPO1U-29	207979.97	2205437.27	8.60
30	GPO1U-30	208004.10	2205424.11	8.56
31	GPO1U-31	207976.41	2205422.66	8.49
32	GPO1U-32	208006.00	2205434.80	8.43
33	GPO1U-33	207975.60	2205440.40	8.42
34	GPO1U-34	207989.88	2205425.80	8.41
35	GPO1U-35	207992.05	2205442.97	8.33
36	GPO1U-36	208003.95	2205434.42	8.32
37	GPO1U-37	208005.60	2205424.80	8.06
38	GPO1U-38	207983.90	2205448.32	8.01
39	GPO1U-39	207989.73	2205440.70	8.00
40	GPO1U-40	207981.57	2205427.99	7.95
41	GPO1U-41	207996.60	2205430.20	7.91
42	GPO1U-42	207997.00	2205431.20	7.65
43	GPO1U-43	207979.00	2205435.20	7.58
44	GPO1U-44	207995.20	2205441.20	7.47
45	GPO1U-45	207992.34	2205426.37	7.44
46	GPO1U-46	207998.02	2205420.45	7.25
47	GPO1U-47	207997.82	2205429.76	7.24
48	GPO1U-48	207999.00	2205430.20	7.19
49	GPO1U-49	207996.60	2205421.80	7.16
50	GPO1U-50	207980.00	2205448.00	7.15
51	GPO1U-51	207981.04	2205433.26	7.13
52	GPO1U-52	208000.80	2205440.80	7.09
53	GPO1U-53	208005.40	2205432.20	6.92
54	GPO1U-54	207998.80	2205420.80	6.92
55	GPO1U-55	208002.00	2205441.00	6.83
56	GPO1U-56	208004.40	2205432.60	6.83
57	GPO1U-57	207981.23	2205436.44	6.80
58	GPO1U-58	207991.00	2205430.00	6.79
59	GPO1U-59	208004.80	2205430.20	6.77
60	GPO1U-60	207982.40	2205444.40	6.73
61	GPO1U-61	207977.00	2205447.20	6.72
62	GPO1U-62	207984.60	2205448.60	6.70
63	GPO1U-63	207980.20	2205444.00	6.70

(file GPO1\_Unknown\_MK2\_Gate3.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
64	GPO1U-64	207999.40	2205449.00	6.68
65	GPO1U-65	207984.40	2205432.80	6.64
66	GPO1U-66	207988.60	2205440.60	6.62
67	GPO1U-67	207994.00	2205424.40	6.61
68	GPO1U-68	208004.55	2205421.63	6.56
69	GPO1U-69	207982.00	2205436.00	6.48
70	GPO1U-70	208005.24	2205423.78	6.47
71	GPO1U-71	207984.20	2205422.80	6.46
72	GPO1U-72	207980.00	2205433.60	6.45
73	GPO1U-73	207991.48	2205440.16	6.39
74	GPO1U-74	207983.68	2205418.21	6.38
75	GPO1U-75	207999.60	2205440.80	6.35
76	GPO1U-76	207988.60	2205447.40	6.34
77	GPO1U-77	208000.78	2205449.32	6.32
78	GPO1U-78	207991.80	2205432.40	6.30
79	GPO1U-79	208001.80	2205448.40	6.27
80	GPO1U-80	207992.56	2205427.09	6.24
81	GPO1U-81	207997.20	2205436.60	6.22
82	GPO1U-82	207996.40	2205441.20	6.20
83	GPO1U-83	207995.83	2205421.67	6.20
84	GPO1U-84	207977.40	2205444.40	6.15
85	GPO1U-85	207977.40	2205441.00	6.14
86	GPO1U-86	207997.20	2205441.60	6.13
87	GPO1U-87	207996.80	2205435.40	6.10
88	GPO1U-88	208005.80	2205433.00	6.06
89	GPO1U-89	207996.40	2205441.80	6.04
90	GPO1U-90	207983.80	2205428.00	6.04
91	GPO1U-91	207993.40	2205427.00	6.01

**F.10.7 WAIKOLOA CONTRACTORS' GRID – EM61MK2 TIME GATE 1**

(File Name: GPO1A\_Contractors\_MK2\_Gate1.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO1A-1	208024.88	2205455.41	415.38
1*	93*	208024.90*	2205455.44*	Seeded*
2	GPO1A-2	208027.64	2205450.09	271.59
2*	109*	208027.70*	2205450.16*	Seeded*
3	GPO1A-3	208030.40	2205455.20	90.41
3*	111*	208030.42*	2205455.22*	Seeded*
4	GPO1A-4	208015.11	2205451.23	76.53
5	GPO1A-5	208026.40	2205439.80	59.86
6	GPO1A-6	208013.86	2205452.33	44.25
7	GPO1A-7	208007.90	2205434.48	39.89

(File Name: GPO1A_Contractors_MK2_Gate1.xls)				
Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
8	GPO1A-8	208028.28	2205429.44	38.53
9	GPO1A-9	208008.80	2205452.40	37.83
10	GPO1A-10	208033.23	2205436.76	37.44
11	GPO1A-11	208024.76	2205446.92	37.25
12	GPO1A-12	208006.20	2205435.20	34.98
13	GPO1A-13	208009.80	2205435.00	34.89
14	GPO1A-14	208008.60	2205435.00	34.48
15	GPO1A-15	208017.71	2205439.60	32.25
16	GPO1A-16	208014.40	2205436.40	31.43
17	GPO1A-17	208017.28	2205435.67	30.76
18	GPO1A-18	208018.37	2205435.85	30.57
19	GPO1A-19	208034.40	2205450.60	30.45
20	GPO1A-20	208012.56	2205451.26	29.55
21	GPO1A-21	208025.09	2205449.41	29.16
21*	110*	208025.04*	2205449.37*	Seeded*
22	GPO1A-22	208033.07	2205448.33	29.13
23	GPO1A-23	208023.70	2205430.12	28.92
24	GPO1A-24	208032.60	2205446.60	28.82
25	GPO1A-25	208009.80	2205434.20	28.02
26	GPO1A-26	208022.80	2205440.14	27.88
27	GPO1A-27	208029.80	2205448.20	27.83
28	GPO1A-28	208012.60	2205452.20	27.71
29	GPO1A-29	208036.20	2205437.40	27.62
30	GPO1A-30	208013.60	2205436.00	27.31
31	GPO1A-31	208017.80	2205439.00	26.62
32	GPO1A-32	208031.80	2205426.40	26.28
33	GPO1A-33	208035.06	2205446.85	26.03
34	GPO1A-34	208027.60	2205430.00	24.67
35	GPO1A-35	208011.40	2205451.40	24.62
36	GPO1A-36	208014.40	2205435.80	24.49
37	GPO1A-37	208016.18	2205454.31	24.47
38	GPO1A-38	208033.80	2205446.80	24.37
39	GPO1A-39	208030.00	2205439.80	24.28
40	GPO1A-40	208026.45	2205428.50	24.05
41	GPO1A-41	208029.20	2205444.40	23.95
42	GPO1A-42	208034.60	2205433.60	23.86
43	GPO1A-43	208005.60	2205452.20	23.82
44	GPO1A-44	208019.63	2205440.33	23.42
45	GPO1A-45	208014.82	2205432.26	23.34
46	GPO1A-46	208023.63	2205445.99	23.04
47	GPO1A-47	208024.52	2205449.27	23.01
48	GPO1A-48	208026.91	2205425.54	23.01
49	GPO1A-49	208032.60	2205436.00	22.93
50	GPO1A-50	208030.15	2205443.02	22.92

(File Name: GPO1A\_Contractors\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
51	GPO1A-51	208008.32	2205453.22	22.71
52	GPO1A-52	208009.89	2205452.58	22.63
53	GPO1A-53	208031.40	2205447.00	22.48
54	GPO1A-54	208035.40	2205437.80	22.42
55	GPO1A-55	208010.40	2205453.00	22.20
56	GPO1A-56	208014.80	2205452.60	21.92
57	GPO1A-57	208036.60	2205434.80	21.88
58	GPO1A-58	208015.60	2205441.00	21.88
59	GPO1A-59	208023.60	2205434.40	21.87
60	GPO1A-60	208010.96	2205433.71	21.57
61	GPO1A-61	208019.50	2205435.76	21.29
62	GPO1A-62	208013.88	2205439.18	21.25
63	GPO1A-63	208032.20	2205438.80	21.14
64	GPO1A-64	208030.20	2205446.60	20.94
65	GPO1A-65	208020.40	2205427.40	20.62
66	GPO1A-66	208019.20	2205439.60	20.51
67	GPO1A-67	208007.72	2205429.78	20.49
68	GPO1A-68	208034.00	2205430.60	20.46
69	GPO1A-69	208027.40	2205430.80	20.35
70	GPO1A-70	208010.60	2205452.00	20.32
71	GPO1A-71	208022.05	2205440.64	20.31
72	GPO1A-72	208019.20	2205427.00	20.25
73	GPO1A-73	208016.64	2205440.16	20.22
74	GPO1A-74	208014.45	2205440.28	20.19
75	GPO1A-75	208011.20	2205452.60	20.03
76	GPO1A-76	208034.00	2205442.80	19.86
77	GPO1A-77	208007.63	2205452.26	19.72
78	GPO1A-78	208015.76	2205432.26	19.68
79	GPO1A-79	208033.10	2205426.79	19.63
80	GPO1A-80	208014.63	2205439.37	19.62
81	GPO1A-81	208032.21	2205449.16	19.60
82	GPO1A-82	208024.60	2205429.40	19.60
83	GPO1A-83	208016.40	2205441.00	19.44
84	GPO1A-84	208028.87	2205444.95	19.42
85	GPO1A-85	208030.80	2205436.20	19.39
86	GPO1A-86	208019.40	2205441.20	19.30
87	GPO1A-87	208027.20	2205445.60	19.18
88	GPO1A-88	208023.90	2205440.89	19.11
89	GPO1A-89	208013.40	2205440.20	18.88
90	GPO1A-90	208032.60	2205447.40	18.75
91	GPO1A-91	208015.50	2205453.65	18.66
92	GPO1A-92	208005.80	2205450.20	18.65
93	GPO1A-93	208020.40	2205426.80	18.61
94	GPO1A-94	208004.60	2205451.20	18.59
95	GPO1A-95	208016.20	2205441.60	18.52

(File Name: GPO1A\_Contractors\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
96	GPO1A-96	208013.60	2205433.20	18.40
97	GPO1A-97	208010.48	2205441.40	18.39
98	GPO1A-98	208009.60	2205440.80	18.26
99	GPO1A-99	208031.65	2205436.19	18.19
100	GPO1A-100	208013.60	2205435.00	18.05
101	GPO1A-101	208011.20	2205434.60	18.05
102	GPO1A-102	208021.80	2205429.00	17.92
103	GPO1A-103	208027.40	2205427.60	17.90
104	GPO1A-104	208012.13	2205433.71	17.89
105	GPO1A-105	208022.28	2205455.59	17.84
106	GPO1A-106	208028.28	2205425.76	17.76
107	GPO1A-107	208029.15	2205425.88	17.72
108	GPO1A-108	208023.99	2205443.70	17.28
109	GPO1A-109	208027.37	2205440.42	17.23
110	GPO1A-110	208012.31	2205441.83	17.22
111	GPO1A-111	208010.60	2205427.00	17.17
112	GPO1A-112	208012.20	2205439.20	17.12
113	GPO1A-113	208036.38	2205430.93	17.07
114	GPO1A-114	208019.00	2205429.00	16.98
115	GPO1A-115	208020.20	2205454.40	16.95
116	GPO1A-116	208021.07	2205435.31	16.73
117	GPO1A-117	208037.47	2205432.09	16.61
118	GPO1A-118	208030.80	2205439.60	16.57
119	GPO1A-119	208032.20	2205434.00	16.48
120	GPO1A-120	208006.60	2205446.00	16.43
121	GPO1A-121	208035.60	2205427.00	16.37
122	GPO1A-122	208015.20	2205454.20	16.33
123	GPO1A-123	208010.17	2205430.71	16.27
124	GPO1A-124	208027.00	2205448.00	16.20
125	GPO1A-125	208034.80	2205430.20	16.12
126	GPO1A-126	208022.40	2205434.60	16.12
127	GPO1A-127	208008.20	2205448.40	16.09
128	GPO1A-128	208019.40	2205429.60	16.07
129	GPO1A-129	208021.60	2205446.60	16.04
130	GPO1A-130	208024.20	2205427.60	16.01
131	GPO1A-131	208015.80	2205425.60	15.94
132	GPO1A-132	208018.00	2205430.20	15.93
133	GPO1A-133	208010.60	2205439.40	15.83
134	GPO1A-134	208036.00	2205434.20	15.82
135	GPO1A-135	208008.40	2205439.20	15.79
136	GPO1A-136	208010.56	2205430.23	15.62
137	GPO1A-137	208021.20	2205441.20	15.54
138	GPO1A-138	208021.40	2205454.00	15.47
139	GPO1A-139	208015.80	2205435.40	15.45
140	GPO1A-140	208027.20	2205434.80	15.34

(File Name: GPO1A\_Contractors\_MK2\_Gate1.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
141	GPO1A-141	208019.80	2205446.40	15.29
142	GPO1A-142	208010.80	2205425.20	15.25
143	GPO1A-143	208015.80	2205424.80	15.09

**F.10.8 WAIKOLOA CONTRACTORS' GRID – EM61MK2 TIME GATE 2**

(file GPO1A\_Contractors\_MK2\_Gate2.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO1A-1	208024.87	2205455.45	266.05
1*	93*	208024.90*	2205455.44*	Seeded*
2	GPO1A-2	208027.70	2205450.20	172.61
2*	109*	208027.70*	2205450.16*	Seeded*
3	GPO1A-3	208030.33	2205455.17	54.72
3*	111*	208030.42*	2205455.22*	Seeded*
4	GPO1A-4	208015.05	2205451.27	50.67
5	GPO1A-5	208026.41	2205439.74	38.85
6	GPO1A-6	208013.84	2205452.32	28.51
7	GPO1A-7	208008.03	2205434.56	25.09
8	GPO1A-8	208024.75	2205446.91	23.37
9	GPO1A-9	208033.40	2205436.75	22.36
10	GPO1A-10	208008.76	2205452.42	21.33
11	GPO1A-11	208006.20	2205435.20	21.08
12	GPO1A-12	208017.72	2205439.59	19.73
13	GPO1A-13	208014.42	2205436.35	19.54
14	GPO1A-14	208009.81	2205434.82	18.94
15	GPO1A-15	208022.80	2205440.20	18.82
16	GPO1A-16	208018.37	2205435.86	18.46
17	GPO1A-17	208012.60	2205451.40	18.31
18	GPO1A-18	208017.27	2205435.70	18.14
19	GPO1A-19	208034.40	2205450.60	18.00
20	GPO1A-20	208023.76	2205430.07	17.92
21	GPO1A-21	208033.04	2205448.31	17.73
22	GPO1A-22	208032.60	2205446.60	17.58
23	GPO1A-23	208029.80	2205448.20	16.93
24	GPO1A-24	208009.83	2205434.18	16.76
25	GPO1A-25	208025.10	2205449.44	16.73
25*	110*	208025.04*	2205449.37*	Seeded*
26	GPO1A-26	208012.60	2205452.20	16.46
27	GPO1A-27	208031.80	2205426.40	16.35
28	GPO1A-28	208013.57	2205435.97	15.73
29	GPO1A-29	208036.18	2205437.29	15.58

(file GPO1A\_Contractors\_MK2\_Gate2.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
30	GPO1A-30	208030.20	2205443.20	15.51
31	GPO1A-31	208026.35	2205428.71	15.18
32	GPO1A-32	208035.00	2205446.80	15.10
33	GPO1A-33	208011.40	2205451.40	14.88
34	GPO1A-34	208030.00	2205439.80	14.77
35	GPO1A-35	208023.60	2205446.00	14.77
36	GPO1A-36	208033.80	2205446.80	14.68
37	GPO1A-37	208026.60	2205428.00	14.66
38	GPO1A-38	208034.74	2205433.77	14.49
39	GPO1A-39	208016.16	2205454.33	14.45
40	GPO1A-40	208019.60	2205435.80	14.28
41	GPO1A-41	208023.60	2205434.40	14.03
42	GPO1A-42	208005.60	2205452.20	13.98
43	GPO1A-43	208020.40	2205427.40	13.88
44	GPO1A-44	208009.90	2205452.48	13.83
45	GPO1A-45	208014.88	2205432.28	13.56
46	GPO1A-46	208019.20	2205427.00	13.54
47	GPO1A-47	208032.20	2205438.80	13.54
48	GPO1A-48	208008.42	2205453.23	13.51
49	GPO1A-49	208019.63	2205440.32	13.33
50	GPO1A-50	208024.25	2205449.32	13.32
51	GPO1A-51	208026.93	2205425.53	13.29
52	GPO1A-52	208014.80	2205452.60	13.24
53	GPO1A-53	208023.93	2205440.57	13.03
54	GPO1A-54	208031.40	2205447.00	13.00
55	GPO1A-55	208015.81	2205441.06	12.97
56	GPO1A-56	208014.40	2205440.40	12.93
57	GPO1A-57	208028.80	2205425.80	12.90
58	GPO1A-58	208022.06	2205440.58	12.77
59	GPO1A-59	208034.00	2205442.80	12.72
60	GPO1A-60	208032.20	2205449.00	12.71
61	GPO1A-61	208030.20	2205446.60	12.62
62	GPO1A-62	208027.60	2205430.00	12.52
63	GPO1A-63	208035.47	2205437.81	12.50
64	GPO1A-64	208028.20	2205429.40	12.50
65	GPO1A-65	208010.07	2205453.03	12.43
66	GPO1A-66	208036.60	2205434.80	12.38
67	GPO1A-67	208010.97	2205433.76	12.20
68	GPO1A-68	208015.76	2205432.29	11.92
69	GPO1A-69	208032.65	2205435.95	11.85
70	GPO1A-70	208015.40	2205453.60	11.77
71	GPO1A-71	208007.60	2205429.60	11.76
72	GPO1A-72	208023.78	2205441.40	11.71
73	GPO1A-73	208036.40	2205430.80	11.67

(file GPO1A\_Contractors\_MK2\_Gate2.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
74	GPO1A-74	208027.40	2205430.80	11.65
75	GPO1A-75	208021.80	2205429.00	11.55
76	GPO1A-76	208007.68	2205452.16	11.48
77	GPO1A-77	208014.32	2205439.34	11.40
78	GPO1A-78	208027.20	2205445.60	11.38
79	GPO1A-79	208016.40	2205440.40	11.37
80	GPO1A-80	208012.06	2205433.63	11.34
81	GPO1A-81	208024.20	2205427.40	11.28
82	GPO1A-82	208033.44	2205426.75	11.23
83	GPO1A-83	208011.10	2205452.19	11.20
84	GPO1A-84	208019.40	2205441.20	11.03
85	GPO1A-85	208029.11	2205444.59	11.01
86	GPO1A-86	208031.41	2205436.10	10.92
87	GPO1A-87	208005.80	2205450.20	10.92
88	GPO1A-88	208033.60	2205433.80	10.89
89	GPO1A-89	208032.20	2205434.00	10.83
90	GPO1A-90	208013.60	2205433.00	10.81
91	GPO1A-91	208034.60	2205427.60	10.68
92	GPO1A-92	208010.60	2205441.40	10.67
93	GPO1A-93	208004.60	2205451.20	10.66
94	GPO1A-94	208011.20	2205434.60	10.65
95	GPO1A-95	208013.40	2205440.20	10.52
96	GPO1A-96	208027.40	2205427.60	10.45
97	GPO1A-97	208012.13	2205441.73	10.40
98	GPO1A-98	208024.00	2205443.40	10.33
99	GPO1A-99	208009.60	2205440.80	10.31
100	GPO1A-100	208013.60	2205435.00	10.29
101	GPO1A-101	208033.80	2205430.60	10.20
102	GPO1A-102	208024.60	2205429.40	10.18
103	GPO1A-103	208027.40	2205440.60	10.14
104	GPO1A-104	208021.22	2205435.42	10.12
105	GPO1A-105	208010.60	2205430.20	10.08
106	GPO1A-106	208020.20	2205454.40	10.07

**F.10.9 WAIKOLOA CONTRACTORS' GRID – EM61MK2 TIME GATE 3**

(file GPO1A\_Contractors\_MK2\_Gate3.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO1A-1	208024.89	2205455.46	147.30
1*	93*	208024.90*	2205455.44*	Seeded*
2	GPO1A-2	208027.66	2205450.12	90.77
2*	109*	208027.70*	2205450.16*	Seeded*
3	GPO1A-3	208015.09	2205451.25	28.48

(file GPO1A\_Contractors\_MK2\_Gate3.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
4	GPO1A-4	208030.19	2205455.22	27.97
4*	111*	208030.42*	2205455.22*	Seeded*
5	GPO1A-5	208026.40	2205439.80	22.79
6	GPO1A-6	208013.85	2205452.33	14.73
7	GPO1A-7	208024.74	2205446.98	13.80
8	GPO1A-8	208008.00	2205434.60	13.79
9	GPO1A-9	208008.80	2205452.40	12.29
10	GPO1A-10	208006.20	2205435.20	12.26
11	GPO1A-11	208009.80	2205435.00	12.00
12	GPO1A-12	208014.40	2205436.40	11.80
13	GPO1A-13	208034.40	2205450.60	10.68
14	GPO1A-14	208033.39	2205436.77	10.63
15	GPO1A-15	208022.80	2205440.20	10.19
16	GPO1A-16	208035.20	2205447.00	9.87
17	GPO1A-17	208018.37	2205435.89	9.81
18	GPO1A-18	208026.40	2205428.80	9.71
19	GPO1A-19	208009.80	2205434.20	9.69
20	GPO1A-20	208017.32	2205439.61	9.68
21	GPO1A-21	208012.57	2205451.10	9.65
22	GPO1A-22	208024.94	2205449.31	9.41
26*	110*	208025.04*	2205449.37*	Seeded*
23	GPO1A-23	208028.80	2205425.80	9.40
24	GPO1A-24	208017.27	2205435.74	9.34
25	GPO1A-25	208033.02	2205448.26	9.33
26	GPO1A-26	208013.60	2205436.00	9.19
27	GPO1A-27	208024.18	2205449.29	9.07
28	GPO1A-28	208027.40	2205430.80	9.07
29	GPO1A-29	208012.60	2205452.20	8.97
30	GPO1A-30	208032.73	2205446.62	8.93
31	GPO1A-31	208033.80	2205446.80	8.92
32	GPO1A-32	208016.20	2205454.40	8.82
33	GPO1A-33	208030.16	2205442.89	8.60
34	GPO1A-34	208034.60	2205434.00	8.53
35	GPO1A-35	208033.00	2205426.80	8.41
36	GPO1A-36	208029.80	2205448.20	8.30
37	GPO1A-37	208019.20	2205427.00	8.21
38	GPO1A-38	208023.60	2205434.60	8.17
39	GPO1A-39	208014.80	2205452.40	8.16
40	GPO1A-40	208024.00	2205440.60	8.07
41	GPO1A-41	208010.00	2205452.40	8.01
42	GPO1A-42	208031.60	2205426.80	7.90
43	GPO1A-43	208015.80	2205432.20	7.87
44	GPO1A-44	208023.69	2205445.98	7.85

(file GPO1A\_Contractors\_MK2\_Gate3.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
45	GPO1A-45	208030.00	2205439.80	7.78
46	GPO1A-46	208015.70	2205440.91	7.77
47	GPO1A-47	208014.92	2205432.31	7.68
48	GPO1A-48	208011.47	2205451.42	7.65
49	GPO1A-49	208031.40	2205446.80	7.63
50	GPO1A-50	208032.24	2205449.09	7.55
51	GPO1A-51	208008.60	2205453.20	7.38
52	GPO1A-52	208023.80	2205430.20	7.38
53	GPO1A-53	208032.20	2205434.00	7.34
54	GPO1A-54	208020.40	2205427.20	7.34
55	GPO1A-55	208018.33	2205440.32	7.33
56	GPO1A-56	208005.60	2205452.20	7.21
57	GPO1A-57	208036.20	2205430.80	7.17
58	GPO1A-58	208014.60	2205439.60	7.16
59	GPO1A-59	208023.60	2205439.80	7.15
60	GPO1A-60	208010.61	2205433.68	7.14
61	GPO1A-61	208016.83	2205441.20	7.13
62	GPO1A-62	208007.60	2205429.60	7.05
63	GPO1A-63	208034.20	2205426.80	7.02
64	GPO1A-64	208015.20	2205426.20	6.91
65	GPO1A-65	208019.60	2205435.80	6.91
66	GPO1A-66	208036.20	2205437.40	6.83
67	GPO1A-67	208010.32	2205453.16	6.79
68	GPO1A-68	208027.81	2205429.96	6.76
69	GPO1A-69	208026.92	2205425.57	6.75
70	GPO1A-70	208019.72	2205440.57	6.74
71	GPO1A-71	208030.06	2205446.69	6.67
72	GPO1A-72	208014.40	2205440.20	6.66
73	GPO1A-73	208035.40	2205433.20	6.62
74	GPO1A-74	208026.80	2205428.00	6.61
75	GPO1A-75	208007.80	2205452.20	6.60
76	GPO1A-76	208013.80	2205433.20	6.51
77	GPO1A-77	208012.13	2205433.68	6.49
78	GPO1A-78	208033.40	2205434.00	6.43
79	GPO1A-79	208029.10	2205444.56	6.40
80	GPO1A-80	208034.00	2205442.80	6.40
81	GPO1A-81	208015.40	2205453.60	6.32
82	GPO1A-82	208010.80	2205425.20	6.22
83	GPO1A-83	208010.60	2205452.00	6.19
84	GPO1A-84	208016.40	2205424.40	6.16
85	GPO1A-85	208022.20	2205435.00	6.14
86	GPO1A-86	208033.60	2205430.20	6.13
87	GPO1A-87	208010.20	2205440.80	6.13
88	GPO1A-88	208025.00	2205429.40	6.13
89	GPO1A-89	208004.60	2205451.20	6.01

(file GPO1A_Contractors_MK2_Gate3.xls)				
Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
90	GPO1A-90	208011.23	2205452.31	6.00

**F.10.10 WAIMEA KNOWN GRID – EM61MK2 TIME GATE 1**

(file GPO2K_Known_MK2_Gate1.xls)				
Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO2K-1	217809.73	2216451.34	136.58
2	GPO2K-2	217797.40	2216462.00	72.71
3	GPO2K-3	217816.15	2216451.45	62.27
4	GPO2K-4	217810.18	2216472.13	44.25
5	GPO2K-5	217813.60	2216471.60	40.39
6	GPO2K-6	217789.00	2216457.00	39.68
7	GPO2K-7	217808.40	2216457.80	38.24
8	GPO2K-8	217818.59	2216453.97	33.65
9	GPO2K-9	217787.60	2216466.80	31.60
10	GPO2K-10	217815.40	2216454.60	28.91
11	GPO2K-11	217788.80	2216472.00	28.39
12	GPO2K-12	217819.33	2216453.67	26.93
13	GPO2K-13	217791.40	2216456.60	26.07
14	GPO2K-14	217796.73	2216467.89	25.42
15	GPO2K-15	217788.00	2216471.40	25.35
16	GPO2K-16	217786.07	2216467.54	24.16
17	GPO2K-17	217786.40	2216466.60	23.46
18	GPO2K-18	217804.60	2216476.20	23.38
19	GPO2K-19	217789.80	2216472.60	22.91
20	GPO2K-20	217794.40	2216448.20	20.54
21	GPO2K-21	217788.60	2216463.20	20.29
22	GPO2K-22	217802.00	2216468.83	20.13
23	GPO2K-23	217794.20	2216457.20	19.76
24	GPO2K-24	217797.57	2216447.40	19.64
25	GPO2K-25	217797.63	2216444.27	18.03
26	GPO2K-26	217811.04	2216469.12	17.98
27	GPO2K-27	217797.49	2216443.69	17.75
28	GPO2K-28	217803.57	2216448.76	17.61
29	GPO2K-29	217800.59	2216454.53	17.34
30	GPO2K-30	217809.15	2216463.04	17.26
31	GPO2K-31	217794.40	2216456.60	17.12
32	GPO2K-32	217814.43	2216457.42	16.93
33	GPO2K-33	217805.40	2216456.20	16.88
34	GPO2K-34	217794.69	2216457.82	16.68
35	GPO2K-35	217809.91	2216462.78	16.44
36	GPO2K-36	217804.93	2216455.68	16.35

(file GPO2K\_Known\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
37	GPO2K-37	217803.37	2216454.10	16.19
38	GPO2K-38	217795.00	2216448.00	15.99
39	GPO2K-39	217813.40	2216465.40	15.75
40	GPO2K-40	217794.67	2216447.13	15.49
41	GPO2K-41	217817.80	2216457.00	15.44
42	GPO2K-42	217788.20	2216465.40	15.34
43	GPO2K-43	217796.71	2216446.71	14.91
44	GPO2K-44	217806.93	2216456.27	14.68
45	GPO2K-45	217788.60	2216462.00	14.67
46	GPO2K-46	217810.00	2216462.00	14.62
47	GPO2K-47	217807.00	2216457.00	14.55
48	GPO2K-48	217798.30	2216447.81	14.19
49	GPO2K-49	217808.20	2216456.40	14.18
50	GPO2K-50	217796.08	2216443.39	14.15
51	GPO2K-51	217807.00	2216470.20	13.95
52	GPO2K-52	217801.80	2216454.80	13.91
53	GPO2K-53	217794.20	2216464.00	13.89
54	GPO2K-54	217796.20	2216444.00	13.73
55	GPO2K-55	217805.16	2216454.70	13.33
56	GPO2K-56	217796.00	2216447.00	13.31
57	GPO2K-57	217798.96	2216462.13	13.31
58	GPO2K-58	217790.00	2216470.00	13.20
59	GPO2K-59	217800.66	2216468.53	13.17
60	GPO2K-60	217806.00	2216455.60	13.14
61	GPO2K-61	217811.69	2216462.24	13.09
62	GPO2K-62	217799.60	2216469.00	12.91
63	GPO2K-63	217789.25	2216466.35	12.75
64	GPO2K-64	217803.56	2216445.27	12.73
65	GPO2K-65	217790.34	2216470.81	12.68
66	GPO2K-66	217804.38	2216454.72	12.63
67	GPO2K-67	217792.62	2216449.74	12.57
68	GPO2K-68	217793.60	2216472.80	12.56
69	GPO2K-69	217804.60	2216454.00	12.45
70	GPO2K-70	217791.40	2216471.40	12.44
71	GPO2K-71	217796.40	2216462.80	12.40
72	GPO2K-72	217802.02	2216454.07	12.29
73	GPO2K-73	217793.00	2216464.00	12.09
74	GPO2K-74	217788.74	2216460.99	12.06
75	GPO2K-75	217795.40	2216453.60	12.05
76	GPO2K-76	217795.00	2216458.49	12.03
77	GPO2K-77	217804.46	2216453.46	12.02
78	GPO2K-78	217812.20	2216463.00	11.85
79	GPO2K-79	217802.15	2216453.34	11.85
80	GPO2K-80	217787.51	2216462.91	11.64
81	GPO2K-81	217813.60	2216457.60	11.52

(file GPO2K\_Known\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	NAD83/UTM Zone 5N <b>X (m)</b>	NAD83/UTM Zone 5N <b>Y (m)</b>	<b>Grid Value (mV)</b>
82	GPO2K-82	217802.40	2216473.40	11.43
83	GPO2K-83	217813.90	2216453.35	11.40
84	GPO2K-84	217791.20	2216470.20	11.34
85	GPO2K-85	217803.60	2216460.40	11.30
86	GPO2K-86	217814.40	2216452.80	11.20
87	GPO2K-87	217789.00	2216459.80	11.12
88	GPO2K-88	217794.60	2216471.80	11.07
89	GPO2K-89	217788.60	2216468.20	10.98
90	GPO2K-90	217802.89	2216455.41	10.88
91	GPO2K-91	217792.80	2216449.00	10.84
92	GPO2K-92	217789.99	2216466.10	10.75
93	GPO2K-93	217815.60	2216462.40	10.65
94	GPO2K-94	217812.80	2216447.80	10.65
95	GPO2K-95	217812.00	2216466.20	10.65
96	GPO2K-96	217796.02	2216445.65	10.62
97	GPO2K-97	217813.80	2216466.20	10.58
98	GPO2K-98	217814.68	2216465.48	10.35
99	GPO2K-99	217807.00	2216455.20	10.23
100	GPO2K-100	217796.44	2216444.67	10.19
101	GPO2K-101	217805.00	2216468.00	10.19
102	GPO2K-102	217805.80	2216461.40	10.19
103	GPO2K-103	217806.20	2216454.80	10.15
104	GPO2K-104	217795.40	2216464.00	10.06
105	GPO2K-105	217795.80	2216456.80	10.02
106	GPO2K-106	217799.15	2216447.33	10.00

**F.10.11 WAIMEA KNOWN GRID – EM61MK2 TIME GATE 2**

(file GPO2K\_Known\_MK2\_Gate2.xls)

<b>Targets</b>	<b>Target ID</b>	NAD83/UTM Zone 5N <b>X (m)</b>	NAD83/UTM Zone 5N <b>Y (m)</b>	<b>Grid Value (mV)</b>
1	GPO2K-1	217809.74	2216451.32	101.32
2	GPO2K-2	217797.40	2216462.00	50.14
3	GPO2K-3	217816.17	2216451.42	40.16
4	GPO2K-4	217810.22	2216472.11	33.26
5	GPO2K-5	217808.42	2216457.83	25.59
6	GPO2K-6	217813.58	2216471.64	25.35
7	GPO2K-7	217789.00	2216457.00	24.51
8	GPO2K-8	217818.60	2216454.00	20.30
9	GPO2K-9	217788.80	2216472.00	19.23
10	GPO2K-10	217815.40	2216454.60	17.79
11	GPO2K-11	217787.72	2216466.87	17.52
12	GPO2K-12	217819.20	2216453.60	17.49
13	GPO2K-13	217804.60	2216476.20	17.25

(file GPO2K\_Known\_MK2\_Gate2.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
14	GPO2K-14	217786.03	2216467.54	17.12
15	GPO2K-15	217788.20	2216471.40	16.87
16	GPO2K-16	217786.40	2216466.40	16.33
17	GPO2K-17	217796.76	2216467.94	16.24
18	GPO2K-18	217811.00	2216469.20	14.23
19	GPO2K-19	217801.90	2216468.75	14.05
20	GPO2K-20	217789.80	2216472.60	14.00
21	GPO2K-21	217794.40	2216448.20	13.58
22	GPO2K-22	217797.75	2216444.27	12.37
23	GPO2K-23	217805.40	2216456.20	12.26
24	GPO2K-24	217797.53	2216443.74	12.25
25	GPO2K-25	217797.52	2216447.36	11.89
26	GPO2K-26	217804.97	2216455.72	11.60
27	GPO2K-27	217809.03	2216462.96	11.51
28	GPO2K-28	217794.80	2216457.80	11.33
29	GPO2K-29	217798.20	2216447.80	10.95
30	GPO2K-30	217795.00	2216448.00	10.88
31	GPO2K-31	217803.60	2216448.80	10.87
32	GPO2K-32	217800.60	2216454.60	10.82
33	GPO2K-33	217794.65	2216447.17	10.80
34	GPO2K-34	217794.24	2216457.06	10.70
35	GPO2K-35	217807.00	2216457.00	10.53
36	GPO2K-36	217803.38	2216454.15	10.44
37	GPO2K-37	217803.40	2216445.20	10.42
38	GPO2K-38	217808.20	2216456.40	10.41
39	GPO2K-39	217806.91	2216456.28	10.41
40	GPO2K-40	217796.71	2216446.68	10.20
41	GPO2K-41	217795.94	2216443.41	10.09
42	GPO2K-42	217817.80	2216457.00	9.77
43	GPO2K-43	217805.11	2216454.68	9.61
44	GPO2K-44	217796.20	2216444.00	9.55
45	GPO2K-45	217813.40	2216465.40	9.54
46	GPO2K-46	217788.74	2216463.26	9.44
47	GPO2K-47	217809.95	2216462.74	9.36
48	GPO2K-48	217794.20	2216464.00	9.20
49	GPO2K-49	217791.40	2216471.60	9.11
50	GPO2K-50	217806.00	2216455.60	8.97
51	GPO2K-51	217801.80	2216454.80	8.88
52	GPO2K-52	217796.40	2216462.80	8.86
53	GPO2K-53	217802.94	2216455.27	8.79
54	GPO2K-54	217804.40	2216454.60	8.68
55	GPO2K-55	217789.25	2216466.34	8.60
56	GPO2K-56	217804.60	2216454.00	8.50
57	GPO2K-57	217810.00	2216462.00	8.49

(file GPO2K\_Known\_MK2\_Gate2.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
58	GPO2K-58	217813.89	2216453.38	8.43
59	GPO2K-59	217802.20	2216453.40	8.28
60	GPO2K-60	217795.76	2216446.93	8.26
61	GPO2K-61	217804.50	2216453.43	8.11
62	GPO2K-62	217807.00	2216470.20	8.05
63	GPO2K-63	217798.95	2216462.26	8.00
64	GPO2K-64	217790.40	2216470.60	7.95
65	GPO2K-65	217795.15	2216458.56	7.93
66	GPO2K-66	217793.60	2216472.80	7.92
67	GPO2K-67	217803.54	2216460.33	7.84
68	GPO2K-68	217799.60	2216469.00	7.82
69	GPO2K-69	217812.20	2216463.00	7.77
70	GPO2K-70	217811.00	2216462.60	7.77
71	GPO2K-71	217802.00	2216454.00	7.74
72	GPO2K-72	217788.60	2216468.20	7.67
73	GPO2K-73	217811.60	2216462.40	7.67
74	GPO2K-74	217807.00	2216455.20	7.65
75	GPO2K-75	217796.01	2216445.52	7.64
76	GPO2K-76	217802.20	2216473.60	7.63
77	GPO2K-77	217787.47	2216462.91	7.63
78	GPO2K-78	217795.40	2216464.00	7.58
79	GPO2K-79	217792.66	2216449.71	7.58
80	GPO2K-80	217806.20	2216454.80	7.56
81	GPO2K-81	217796.60	2216444.80	7.56
82	GPO2K-82	217791.40	2216456.60	7.55
83	GPO2K-83	217789.99	2216466.10	7.55
84	GPO2K-84	217814.40	2216457.40	7.52
85	GPO2K-85	217814.40	2216452.80	7.46
86	GPO2K-86	217792.99	2216464.03	7.43
87	GPO2K-87	217800.60	2216468.40	7.41
88	GPO2K-88	217792.80	2216449.00	7.34
89	GPO2K-89	217813.60	2216457.80	7.32
90	GPO2K-90	217815.58	2216462.36	7.30
91	GPO2K-91	217814.60	2216465.40	7.20
92	GPO2K-92	217805.73	2216461.29	7.19
93	GPO2K-93	217812.00	2216466.20	7.18
94	GPO2K-94	217812.80	2216447.80	7.17
95	GPO2K-95	217799.17	2216447.35	7.00

**F.10.12 WAIMEA KNOWN GRID – EM61MK2 TIME GATE 3**

(file GPO2K\_Known\_MK2\_Gate3.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
1	GPO2K-1	217809.74	2216451.31	67.71

(file GPO2K\_Known\_MK2\_Gate3.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
2	GPO2K-2	217797.40	2216462.00	27.24
3	GPO2K-3	217810.20	2216472.16	23.70
4	GPO2K-4	217816.14	2216451.46	20.95
5	GPO2K-5	217813.60	2216471.60	15.20
6	GPO2K-6	217808.45	2216457.80	14.56
7	GPO2K-7	217789.00	2216457.00	12.61
8	GPO2K-8	217788.80	2216472.00	11.27
9	GPO2K-9	217785.95	2216467.58	10.69
10	GPO2K-10	217787.69	2216466.88	10.55
11	GPO2K-11	217788.20	2216471.20	9.67
12	GPO2K-12	217796.60	2216467.80	9.66
13	GPO2K-13	217818.73	2216453.86	9.64
14	GPO2K-14	217811.00	2216469.20	9.61
15	GPO2K-15	217786.40	2216466.60	9.35
16	GPO2K-16	217815.48	2216454.65	9.33
17	GPO2K-17	217804.60	2216476.20	8.71
18	GPO2K-18	217789.80	2216472.60	8.66
19	GPO2K-19	217802.00	2216468.80	8.43
20	GPO2K-20	217794.30	2216448.10	7.92
21	GPO2K-21	217797.53	2216443.76	7.54
22	GPO2K-22	217797.72	2216444.45	7.50
23	GPO2K-23	217804.88	2216455.69	7.24
24	GPO2K-24	217809.03	2216463.05	6.92
25	GPO2K-25	217797.37	2216447.28	6.75
26	GPO2K-26	217794.53	2216457.57	6.72
27	GPO2K-27	217805.65	2216456.19	6.65
28	GPO2K-28	217803.00	2216455.00	6.65
29	GPO2K-29	217794.69	2216447.08	6.62
30	GPO2K-30	217796.60	2216446.60	6.57
31	GPO2K-31	217798.20	2216447.80	6.43
32	GPO2K-32	217803.32	2216454.17	6.36
33	GPO2K-33	217803.40	2216445.20	6.30
34	GPO2K-34	217803.62	2216448.74	6.14
35	GPO2K-35	217789.20	2216466.40	6.04
36	GPO2K-36	217796.03	2216443.42	6.00
37	GPO2K-37	217788.73	2216463.35	5.97
38	GPO2K-38	217805.21	2216454.69	5.97
39	GPO2K-39	217794.20	2216464.00	5.96
40	GPO2K-40	217796.40	2216462.80	5.89
41	GPO2K-41	217800.60	2216454.40	5.86
42	GPO2K-42	217809.99	2216462.76	5.75
43	GPO2K-43	217807.07	2216456.73	5.73
44	GPO2K-44	217806.00	2216455.60	5.63

(file GPO2K\_Known\_MK2\_Gate3.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
45	GPO2K-45	217810.00	2216462.00	5.43
46	GPO2K-46	217791.40	2216471.60	5.41
47	GPO2K-47	217795.20	2216458.80	5.40
48	GPO2K-48	217801.80	2216454.80	5.11
49	GPO2K-49	217788.60	2216468.20	5.10
50	GPO2K-50	217795.91	2216445.41	5.08
51	GPO2K-51	217808.20	2216456.40	5.07
52	GPO2K-52	217793.60	2216456.80	5.06
53	GPO2K-53	217792.57	2216449.68	5.06
54	GPO2K-54	217813.62	2216465.63	5.03
55	GPO2K-55	217790.00	2216466.00	5.03
56	GPO2K-56	217795.78	2216446.89	5.00
57	GPO2K-57	217817.80	2216457.00	4.92
58	GPO2K-58	217798.96	2216462.24	4.90
59	GPO2K-59	217802.00	2216473.60	4.89
60	GPO2K-60	217796.15	2216444.22	4.87
61	GPO2K-61	217813.89	2216453.38	4.83
62	GPO2K-62	217795.80	2216456.80	4.75
63	GPO2K-63	217804.60	2216454.00	4.75
64	GPO2K-64	217800.60	2216468.40	4.73
65	GPO2K-65	217814.40	2216452.80	4.71
66	GPO2K-66	217799.60	2216469.00	4.67
67	GPO2K-67	217811.60	2216462.40	4.66
68	GPO2K-68	217787.42	2216462.99	4.60
69	GPO2K-69	217804.38	2216453.48	4.59
70	GPO2K-70	217799.08	2216447.30	4.57
71	GPO2K-71	217807.00	2216455.20	4.56
72	GPO2K-72	217790.27	2216470.99	4.56
73	GPO2K-73	217788.20	2216465.40	4.56
74	GPO2K-74	217795.40	2216464.00	4.53
75	GPO2K-75	217812.20	2216463.00	4.46
76	GPO2K-76	217806.20	2216454.80	4.46
77	GPO2K-77	217793.20	2216449.00	4.33
78	GPO2K-78	217802.08	2216453.87	4.31
79	GPO2K-79	217796.40	2216459.80	4.30
80	GPO2K-80	217807.00	2216470.20	4.26
81	GPO2K-81	217814.60	2216465.40	4.25
82	GPO2K-82	217813.60	2216457.60	4.19
83	GPO2K-83	217812.00	2216466.20	4.13
84	GPO2K-84	217793.00	2216464.00	4.12
85	GPO2K-85	217805.80	2216461.40	4.10
86	GPO2K-86	217791.20	2216470.20	4.08
87	GPO2K-87	217803.60	2216460.20	4.07
88	GPO2K-88	217812.76	2216448.08	4.00

**F.10.13 WAIMEA TRANSECT – EM61MK2 TIME GATE 1**

(file GPO2\_Transect\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
1	GPO2T-1	217783.78	2216532.71	31.59
2	GPO2T-2	217792.60	2216500.51	27.99
3	GPO2T-3	217796.54	2216487.73	23.48
4	GPO2T-4	217798.79	2216480.30	22.44
5	GPO2T-5	217798.80	2216478.40	18.54
6	GPO2T-6	217801.98	2216468.74	18.20
7	GPO2T-7	217805.22	2216456.25	14.00
8	GPO2T-8	217793.60	2216496.80	12.36
9	GPO2T-9	217796.80	2216485.40	10.83
10	GPO2T-10	217795.60	2216490.40	10.82
11	GPO2T-11	217805.96	2216455.43	10.20

**F.10.14 WAIMEA TRANSECT – EM61MK2 TIME GATE 2**

(file GPO2\_Transect\_MK2\_Gate2.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
1	GPO2T-1	217783.79	2216532.67	21.24
2	GPO2T-2	217792.60	2216500.52	17.52
3	GPO2T-3	217796.57	2216487.72	16.70
4	GPO2T-4	217798.80	2216480.35	15.25
5	GPO2T-5	217801.98	2216468.75	12.41
6	GPO2T-6	217798.80	2216478.40	12.17
7	GPO2T-7	217805.18	2216456.27	8.87
8	GPO2T-8	217805.80	2216456.00	8.17
9	GPO2T-9	217793.60	2216496.80	7.85

**F.10.15 WAIMEA TRANSECT – EM61MK2 TIME GATE 3**

(file GPO2\_Transect\_MK2\_Gate3.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
1	GPO2T-1	217783.80	2216532.75	12.34
2	GPO2T-2	217792.62	2216500.32	10.78
3	GPO2T-3	217798.90	2216480.19	9.21
4	GPO2T-4	217796.57	2216487.76	8.24
5	GPO2T-5	217801.97	2216468.75	7.76
6	GPO2T-6	217798.85	2216478.31	7.09
7	GPO2T-7	217805.23	2216456.16	5.70
8	GPO2T-8	217793.63	2216496.70	4.58
9	GPO2T-9	217805.93	2216455.49	4.07

**F.10.16 WAIMEA MEANDERING PATH – EM61MK2 TIME GATE 1**

(file GPO2\_MP+Meandering Path\_MK2\_Gate1.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
1	GPO2U_MP-1	217779.96	2216491.00	39.97
2	GPO2U_MP-2	217798.80	2216498.80	37.89
3	GPO2U_MP-3	217806.40	2216496.40	35.20
4	GPO2U_MP-4	217788.48	2216477.51	34.72
5	GPO2U_MP-5	217782.81	2216484.60	34.57
6	GPO2U_MP-6	217792.01	2216487.56	34.35
7	GPO2U_MP-7	217781.31	2216487.20	29.24
8	GPO2U_MP-8	217803.20	2216505.00	27.51
9	GPO2U_MP-9	217797.40	2216501.40	25.93
10	GPO2U_MP-10	217796.60	2216494.89	25.38
11	GPO2U_MP-11	217778.76	2216496.81	22.17
12	GPO2U_MP-12	217798.60	2216506.40	20.12
13	GPO2U_MP-13	217784.79	2216501.12	19.77
14	GPO2U_MP-14	217793.19	2216491.85	19.00
15	GPO2U_MP-15	217793.40	2216482.49	17.49
16	GPO2U_MP-16	217793.00	2216491.20	16.76
17	GPO2U_MP-17	217802.78	2216507.87	16.61
18	GPO2U_MP-18	217806.07	2216494.84	16.28
19	GPO2U_MP-19	217787.81	2216478.29	15.94
20	GPO2U_MP-20	217794.57	2216478.12	15.43
21	GPO2U_MP-21	217793.99	2216482.88	15.32
22	GPO2U_MP-22	217794.58	2216483.31	14.98
23	GPO2U_MP-23	217786.68	2216479.73	12.20
24	GPO2U_MP-24	217786.24	2216501.64	12.18
25	GPO2U_MP-25	217778.80	2216496.00	11.71
26	GPO2U_MP-26	217799.86	2216480.78	11.17
27	GPO2U_MP-27	217780.88	2216499.80	11.13
28	GPO2U_MP-28	217798.78	2216486.71	10.71
29	GPO2U_MP-29	217804.80	2216501.40	10.01

**F.10.17 WAIMEA MEANDERING PATH – EM61MK2 TIME GATE 2**

(file GPO2\_MP\_Meandering Path\_MK2\_Gate2.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
1	GPO2U_MP-1	217779.95	2216490.99	26.60
2	GPO2U_MP-2	217798.80	2216498.80	25.94
3	GPO2U_MP-3	217792.00	2216487.60	24.14
4	GPO2U_MP-4	217806.38	2216496.30	23.21
5	GPO2U_MP-5	217782.80	2216484.60	22.86

(file GPO2\_MP\_Meandering Path\_MK2\_Gate2.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
6	GPO2U_MP-6	217788.42	2216477.54	22.82
7	GPO2U_MP-7	217803.20	2216505.00	20.04
8	GPO2U_MP-8	217781.31	2216487.18	19.29
9	GPO2U_MP-9	217796.60	2216494.87	17.41
10	GPO2U_MP-10	217797.40	2216501.40	17.08
11	GPO2U_MP-11	217778.76	2216496.84	15.60
12	GPO2U_MP-12	217784.78	2216501.09	15.56
13	GPO2U_MP-13	217798.58	2216506.35	14.63
14	GPO2U_MP-14	217793.40	2216482.60	13.43
15	GPO2U_MP-15	217793.13	2216491.73	12.86
16	GPO2U_MP-16	217806.00	2216494.80	12.31
17	GPO2U_MP-17	217787.80	2216478.20	12.02
18	GPO2U_MP-18	217802.78	2216507.87	11.75
19	GPO2U_MP-19	217793.99	2216482.90	11.73
20	GPO2U_MP-20	217794.58	2216483.31	11.22
21	GPO2U_MP-21	217794.44	2216478.03	10.16
22	GPO2U_MP-22	217786.20	2216501.60	9.74
23	GPO2U_MP-23	217778.80	2216496.00	9.52
24	GPO2U_MP-24	217780.86	2216499.78	8.61
25	GPO2U_MP-25	217804.80	2216501.40	8.16
26	GPO2U_MP-26	217798.80	2216486.80	7.75
27	GPO2U_MP-27	217786.68	2216479.74	7.48
28	GPO2U_MP-28	217799.67	2216480.70	7.00

**F.10.18 WAIMEA MEANDERING PATH – EM61MK2 TIME GATE 3**

(file GPO2\_MP\_Meandering Path\_MK2\_Gate3.xls)

Targets	Target ID	NAD83/UTM Zone 5N X (m)	NAD83/UTM Zone 5N Y (m)	Grid Value (mV)
1	GPO2U_MP-1	217779.90	2216491.17	13.61
2	GPO2U_MP-2	217798.80	2216498.80	13.58
3	GPO2U_MP-3	217806.40	2216496.40	12.49
4	GPO2U_MP-4	217788.40	2216477.60	12.24
5	GPO2U_MP-5	217791.99	2216487.40	11.28
6	GPO2U_MP-6	217782.80	2216484.59	10.84
7	GPO2U_MP-7	217803.20	2216505.00	9.33
8	GPO2U_MP-8	217784.84	2216501.13	8.57
9	GPO2U_MP-9	217797.44	2216501.39	7.54
10	GPO2U_MP-10	217778.76	2216496.79	7.52
11	GPO2U_MP-11	217781.28	2216487.23	7.19
12	GPO2U_MP-12	217796.59	2216494.88	6.74
13	GPO2U_MP-13	217793.41	2216482.50	6.42

(file GPO2\_MP\_Meandering Path\_MK2\_Gate3.xls)

<b>Targets</b>	<b>Target ID</b>	<b>NAD83/UTM Zone 5N X (m)</b>	<b>NAD83/UTM Zone 5N Y (m)</b>	<b>Grid Value (mV)</b>
14	GPO2U_MP-14	217793.15	2216491.81	6.01
15	GPO2U_MP-15	217794.01	2216482.88	5.78
16	GPO2U_MP-16	217798.59	2216506.36	5.70
17	GPO2U_MP-17	217787.81	2216478.30	5.20
18	GPO2U_MP-18	217806.10	2216494.91	5.00
19	GPO2U_MP-19	217794.60	2216483.31	4.99
20	GPO2U_MP-20	217794.54	2216478.10	4.98
21	GPO2U_MP-21	217802.78	2216507.87	4.62
22	GPO2U_MP-22	217781.05	2216499.86	4.00

## **F.11 COLOR MAPS**

The site and location maps, the “as built” GPO map, and the color maps referred to in section B.7.2 above are included here.

**F.12 REPORT ADDENDUM FOR BASALT DISCRIMINATION WITH THE EM61-MK2**

This addendum will be provided under separate cover.

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**APPENDIX G      MINIMUM SEPARATION DISTANCE CALCULATION SHEETS**

The Minimum Separation Distances Calculation Sheets will be included in this section upon receipt from USAESCH. It is anticipated that this will be included as part of the final Phase III EE/CA Work Plan.



Minimum Separation Distances

Waikoloa

155mm M107

20 May 2003

REQUESTED BY: Jerry Kresge

PREPARED BY: Sherene Opichka

**This form shows calculated distances only. It does not constitute approval. Concurrence of CEHNC-OE-S is required to determine the applicable distance for a specific site.**

In accordance with (IAW) EM 1110-1-4009, the minimum separation distance for unintentional detonations shall be the largest of the maximum fragment range, the K50 ( $50W^{1/3}$  where W is the total net explosive weight for the detonation) overpressure distance or 200 ft. In accordance with (IAW) EM 1110-1-4009, use of the range to no more than 1 hazardous fragment/600 sq ft as the minimum separation distance for unintentional detonations requires written justification, a risk analysis, calculation of this distance by CEHNC-ED-CS-S, and concurrence of CEHNC-OE-S.

IAW EM 1110-1-4009, the minimum separation distance for intentional detonations shall be the largest of the maximum fragment range, the K328 ( $328W^{1/3}$  where W is the total net explosive weight for the detonation) overpressure distance or 200 ft.

CALCULATED FRAGMENT DISTANCES

Maximum Fragment Range = 2577 ft

Range to No More Than 1 Hazardous Fragment/600 sq ft = 447 ft

CALCULATED OVERPRESSURE DISTANCES BASED ON OE ITEM'S EXPLOSIVE WEIGHT ONLY (i.e. NO DONOR CHARGE)

Range to 0.9 psi Overpressure (K50) = 141 ft

K328 Overpressure Range = 922 ft (based on munition NEW only, no donor)

The primary fragmentation characteristics used in the calculation of the values listed above were computed IAW CEHNC-ED-CS-S-98-1. The maximum fragment range was calculated using the maximum weight fragment and the initial velocity from these characteristics in the computer software TRAJ. The range to no more than 1 hazardous fragment/600 sq ft was calculated IAW CEHNC-ED-CS-S-98-2.

**NOTE THAT ALL MITIGATION METHODS FOR INTENTIONAL DETONATIONS ARE BASED ON THE USE OF COMMERCIAL SHAPED CHARGES FOR INITIATION. IF ANY OTHER DONOR CHARGE IS TO BE USED THIS INFORMATION MUST BE PROVIDED TO CEHNC WITH A REQUEST FOR NEW CALCULATIONS!**

Minimum Separation Distances

Waikoloa

155mm M107

20 May 2003

SANDBAG ENCLOSURE FOR INTENTIONAL DETONATIONS

Required Sandbag Thickness = 36 in. with 6" standoff between munition and sandbags

Sandbag Throw Distance = 220 ft

Minimum Separation Distance = 220 ft

The required sandbag thickness and the sandbag throw distance were calculated IAW CEHNC-ED-CS-S-98-7. A copy of HNC-ED-CS-S-98-7, "Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions" must be available on site.

WATER MITIGATION FOR INTENTIONAL DETONATIONS

Water Containment System (see HNC-ED-CS-S-00-3)	Minimum Separation Distance (ft)
1100 gallon tank	275

The water containment system and the minimum separation distance were determined IAW HNC-ED-CS-S-00-3. A copy of HNC-ED-CS-S-00-3, "Use of Water for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions" must be available on site.

MINIMUM SEPARATION DISTANCES WHILE USING OFB DURING INTRUSIVE ACTIVITIES

Design of the Open Front Barricade (OFB) is in accordance with HNC-ED-CS-S-99-1, "Open Front and Enclosed Barricades". A copy of this report must be available on site. DDESB has placed certain restrictions on the approved usage of the OFB. These are listed in the approval letter in the front of the report.

Thickness of Aluminum Required to Prevent Perforation = 2.59 in

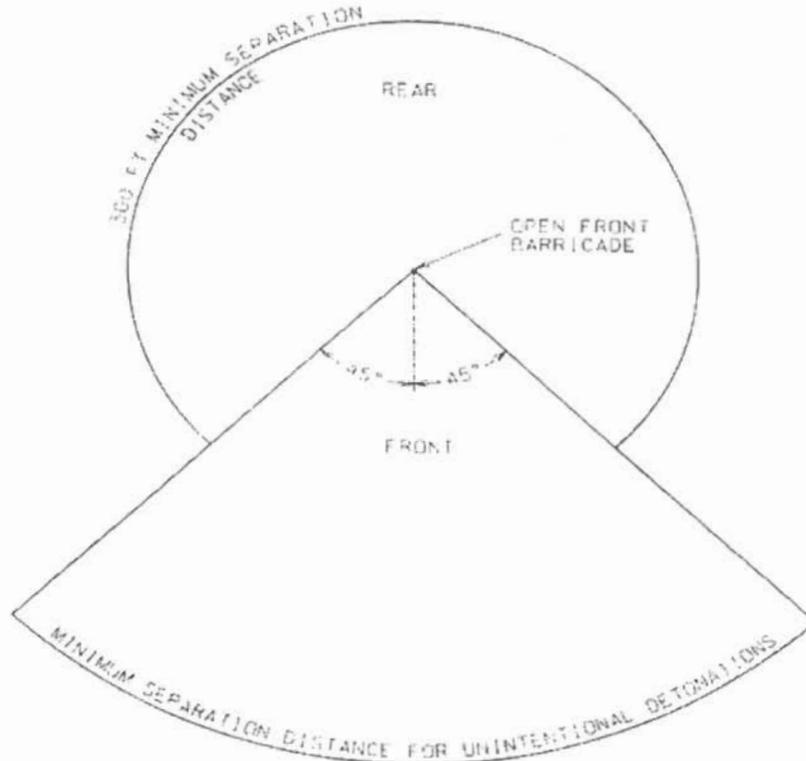
Thickness of Steel Required to Prevent Perforation = 1.27 in

The OFB is designed to defeat fragments to the rear and sides of the OFB in the case of an accidental/unintentional detonation during intrusive activities. The fragment distances to the front of the OFB are the same as the fragment distances without the OFB (see figure). The OFB is not designed to reduce the effects of blast overpressure. The OFB may not be used for intentional detonations. The minimum separation distances to the rear and sides of the

Minimum Separation Distances  
Waikoloa  
155mm M107  
20 May 2003

OFB must be maintained based on the expected throw distance of the OFB itself.

Minimum Separation Distance to sides and rear = 300 ft  
Minimum Separation Distance to front = 2577 ft  
K50 distance = 141 ft



MINIMUM SEPARATION DISTANCE FOR UNINTENTIONAL DETONATIONS  
USING OPEN FRONT BARRICADE DURING INTRUSIVE ACTIVITIES

SIGNATURES:

Sherene Crichton 5/20/03  
Subject Matter Expert Date

Michelle Cull 5/20/03  
QA Reviewer Date

Minimum Separation Distances  
Waikoloa  
MK II Hand Grenade  
20 May 2003

REQUESTED BY: Jerry Kresge  
PREPARED BY: Sherene Opichka

**This form shows calculated distances only. It does not constitute approval. Concurrence of CEHNC-OE-S is required to determine the applicable distance for a specific site.**

In accordance with (IAW) EM 1110-1-4009, the minimum separation distance for unintentional detonations shall be the largest of the maximum fragment range, the K50 ( $50W^{1/3}$  where W is the total net explosive weight for the detonation) overpressure distance or 200 ft. In accordance with (IAW) EM 1110-1-4009, use of the range to no more than 1 hazardous fragment/600 sq ft as the minimum separation distance for unintentional detonations requires written justification, a risk analysis, calculation of this distance by CEHNC-ED-CS-S, and concurrence of CEHNC-OE-S.

IAW EM 1110-1-4009, the minimum separation distance for intentional detonations shall be the largest of the maximum fragment range, the K328 ( $328W^{1/3}$  where W is the total net explosive weight for the detonation) overpressure distance or 200 ft.

CALCULATED FRAGMENT DISTANCES

Maximum Fragment Range = 650 ft  
Range to No More Than 1 Hazardous Fragment/600 sq ft = 400 ft

CALCULATED OVERPRESSURE DISTANCES BASED ON OE ITEM'S  
EXPLOSIVE WEIGHT ONLY (i.e. NO DONOR CHARGE)

Range to 0.9 psi Overpressure (K50) = 27 ft  
K328 Overpressure Range = 174 ft (based on munition NEW only, no donor)

The primary fragmentation characteristics used in the calculation of the values listed above were computed IAW CEHNC-ED-CS-S-98-1. The maximum fragment range was calculated using the maximum weight fragment and the initial velocity from these characteristics in the computer software TRAJ. The range to no more than 1 hazardous fragment/600 sq ft was calculated IAW CEHNC-ED-CS-S-98-2.

**NOTE THAT ALL MITIGATION METHODS FOR INTENTIONAL  
DETONATIONS ARE BASED ON THE USE OF COMMERCIAL SHAPED  
CHARGES FOR INITIATION. IF ANY OTHER DONOR CHARGE IS TO BE  
USED THIS INFORMATION MUST BE PROVIDED TO CEHNC WITH A  
REQUEST FOR NEW CALCULATIONS!**

Minimum Separation Distances  
Waikoloa  
MK II Hand Grenade  
20 May 2003

SANDBAG ENCLOSURE FOR INTENTIONAL DETONATIONS

Required Sandbag Thickness = 12 in. with 6" standoff between munition and sandbags

Sandbag Throw Distance = 25 ft

Minimum Separation Distance = 200 ft

The required sandbag thickness and the sandbag throw distance were calculated IAW CEHNC-ED-CS-S-98-7. A copy of HNC-ED-CS-S-98-7, "Use of Sandbags for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions" must be available on site.

WATER MITIGATION FOR INTENTIONAL DETONATIONS

Water Containment System (see HNC-ED-CS-S-00-3)	Minimum Separation Distance (ft)
5 gallon carboys	200
Inflatable pool	200

The water containment system and the minimum separation distance were determined IAW HNC-ED-CS-S-00-3. A copy of HNC-ED-CS-S-00-3, "Use of Water for Mitigation of Fragmentation and Blast Effects Due to Intentional Detonation of Munitions" must be available on site

MINIMUM SEPARATION DISTANCES WHILE USING MOFB DURING INTRUSIVE ACTIVITIES

Design of the Miniature Open Front Barricade (MOFB) is in accordance with HNC-ED-CS-S-98-8, "Miniature Open Front Barricade". A copy of this report must be available on site. DDESB has placed certain restrictions on the approved usage of the MOFB. These are listed in the approval letter in the front of the report.

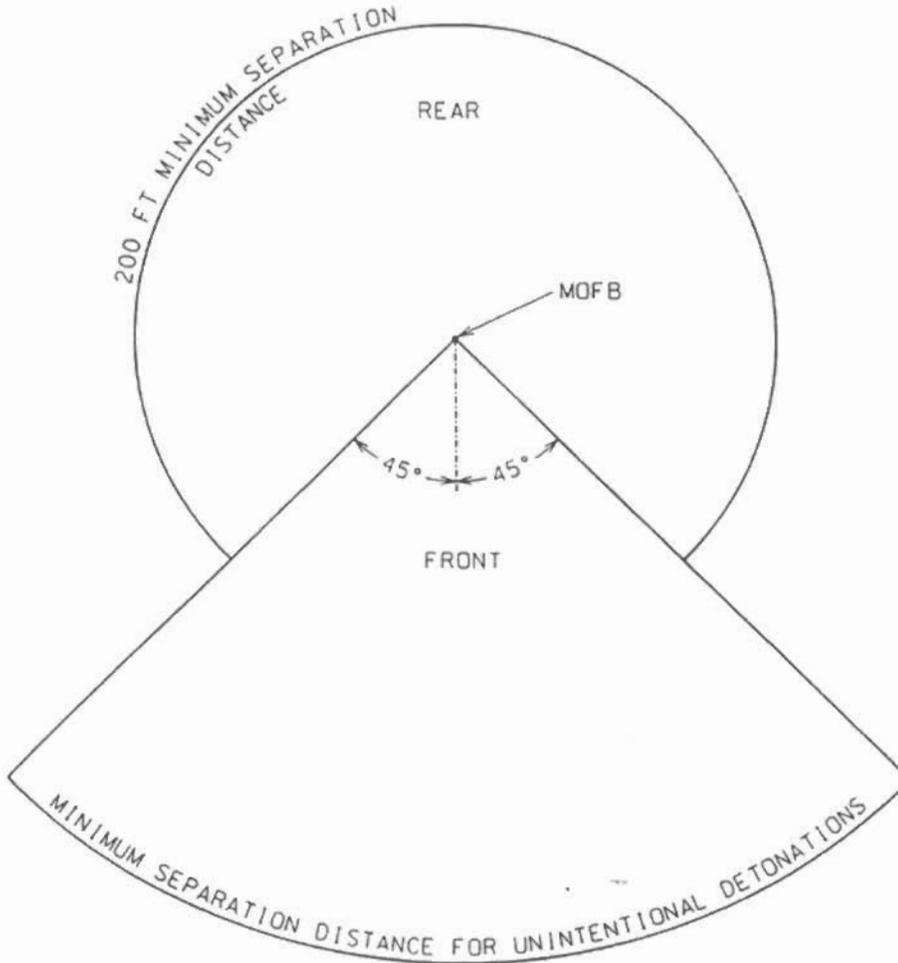
Thickness of Aluminum Required to Prevent Perforation = 1.00 in

The MOFB is designed to defeat fragments to the rear and sides of the MOFB in the case of an accidental/unintentional detonation during intrusive activities. The fragment distances to the front of the MOFB are the same as the fragment distances without the MOFB (see figure). The MOFB is not designed to reduce the effects of blast overpressure. The MOFB may not be used for intentional detonations. The minimum separation distances to the rear and sides of the

Minimum Separation Distances  
Waikoloa  
MK II Hand Grenade  
20 May 2003

MOFB must be maintained based on the expected throw distance of the MOFB itself.

Minimum Separation Distance to sides and rear = 200 ft  
Minimum Separation Distance to front = 650 ft  
K50 distance = 27 ft



MINIMUM SEPARATION DISTANCE FOR UNINTENTIONAL DETONATIONS  
USING MINIATURE OPEN FRONT BARRICADE DURING INTRUSIVE ACTIVITIES

SIGNATURES:

Sherene Opichka 5/20/03  
Subject Matter Expert Date

Michelle Cull 5/20/03  
QA Reviewer Date

**APPENDIX H      RESUMES**



**Education** B.S., Chemical Engineering & Materials Engineering, The University of Connecticut, May 1996

**Registration** Registered Professional Engineer (State of Maryland, No. 29261)

**Professional Training**

- 24-Hour Hazardous Waste Operations and Emergency Response/8-Hour Annual Refreshers
- 8-Hour Hazardous Waste Operations and Emergency Response Supervisor Training
- American Red Cross CPR/First Aid Certification
- RCRA Hazardous Waste Management Training
- ISO14001 Internal Auditor Training

### Professional Experience

**09/2003 – Present USA Environmental, Incorporated – Tampa, Florida**

As Environmental Engineer, Mr. Synakorn provides project management, technical and analytical project support, and report writing support to various environmental projects under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Resource Conservation and Recovery Act (RCRA), supporting Department of Defense initiatives at unexploded ordnance and chemical warfare materiel sites. Responsibilities include technical guidance, quality assurance, project coordination, and cost management.

- Serves as the Project Manager for the Phase III Ordnance and Explosives Engineering Evaluation/Cost Analysis of the former Waikoloa Maneuver Area.
- Serves as the Professional Engineer-In-Charge for various projects, providing engineering guidance, technical writing support, and quality review of project deliverables.

**10/2001 – 08/2003 General Physics Corporation – Edgewood, Maryland**

As Sr. Environmental Engineer, Mr. Synakorn provides technical, analytical, and report writing support to various projects in the CERCLA remediation process, in support of the U.S. Army Garrison Aberdeen Proving Ground's Installation Restoration Program (IRP).

- Served as the Task Manager for projects within the former Nike Missile Battery, specifically, Long-Term Monitoring of the Former Nike Missile Battery Site, Operations and Maintenance of the Nike Groundwater Treatment System, and Operations and Maintenance of the Nike Southwest Landfill.
- Served as the Field Operations Manager for the Canal Creek and Westwood Area Northern Boundary Survey.
- Developed the Remedial Design Plan for the Remedial Action at the Cluster 5 Concrete Slab Test Site, consisting of the technical design approach, health and safety, quality control, and erosion control provisions

- Developed the Project Plan for the Maxwell Point Offshore Investigation, consisting of the technical approach and health and safety provisions
- Developed Health and Safety Plan for the Removal Action at the Cluster 2 Grenade/ Incendiary Disposal/Burn Pit D and for site investigations in the Other Edgewood Areas
- Analyzed monitoring data and prepared the long-term monitoring annual report for the Old Bush River Road Dump and Watson Creek operable units

**03/1998 – 09/2001 King Industries, Incorporated – Norwalk, Connecticut**

As Environmental Engineer, Mr. Synakorn ensured plant-wide environmental compliance to all state and federal permits and regulations, tracking waste generation, ensuring proper waste management, identifying waste minimization opportunities, and monitoring discharge and emissions.

- Designed carbon treatment system for process wastewater to reduce downtime and man hours required in processing of spent carbon
- Characterized waste streams and developed waste minimization plan which include recycling, reclamation, and reduction
- Re-issuance of wastewater discharge permit through the state DEP
- Monitored plant processes for compliance with state permits and federal regulations
- Conducted ISO14001 audits to confirm environmental system compliance
- Monthly reporting of wastewater discharges and analytical results to the state DEP
- Quarterly fugitive emissions leak testing in accordance with 40CFR Part 265 Subpart BB & CC, and RCSA 22a-174-20(x)

As Production Engineer, Mr. Synakorn assumed the role of plant supervisor during the 2<sup>nd</sup> shift, communicating production goals, ensuring safe work practices, identifying batch and process inefficiencies, and monitoring product and process quality.

- Supervised activities of Production operators, drummers, and off-shift mechanics
- Scheduled batch production to meet weekly production plan
- Monitored processes for compliance with company quality standards
- Reviewed batch results and updated batch production sheets for process improvements
- Conducted ISO9001 audit to confirm quality system compliance
- Initiated actions to prevent product, process and quality system non-conformities in accordance with ISO 9001
- Approved required overtime to meet production demand
- Assisted in Operator training

**DOUGLAS D. RALSTON****SENIOR UXO SUPERVISOR**

Date Completed Basic EOD School: August 1971

Never been removed from an EOD/UXO assignment for personnel reliability.

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**EOD/UXO Assignments:**

- Sep 71 - Feb 72 EOD Specialist, 53d Ord Det EOD, Vancouver, WA. Learned basic EOD Operations and how to be a team member. First Range clearance at Yakima Firing range.
- Mar 72 - Apr 73 EOD Specialist; 510th Ord Det EOD, Northern Greece. Learned nuclear operations in this unit. PPE monitoring hotline for nuclear contamination and work on nuclear weapons.
- Apr 73 - Mar 74 EOD Specialist; 142D Ord Det EOD, Ft McClellan, AL. Participated in "Peacetime" chemical disposal of all Agents when the Chemical Schools closed. Learned the trade conventional response & range work.
- Mar 74 - Aug 78 EOD Supervisor; 547th Ord Det EODCT, Ft Gillem, GA. Staff position involving training of subordinate EOD units, funding, operations, and security. Participated in incident responses at Ft Bragg, NC and Ft McClellan, AL.
- Aug 78 - Aug 81 EOD Supervisor; 13th Ord Det EOD, Ft. Gillem, GA; Responding to several hundred incidents as team leader. Taught classes for safety and was involved in production of the EOD Range Clearance movie.
- Nov 81 - Aug 84 EOD Supervisor; 72d Ord Det EOD, Bremerhaven, Germany; Typical work in dark world of Northern Germany. Extensive work for 3 years at Grafenwoehr the largest training area in Germany.
- Aug 84 - Aug 85 EOD Supervisor; 2d Ord Det EOD, Grafenwoehr, Germany; Responded to chemicals located at Grafenwoehr. Responsible within unit for over 400 EOD incidents and the destruction of 12,000 tons of DEMO 2 and small range work at Grafenwoehr.
- Oct 85 - Aug 87 EOD Supervisor; 87th Ord Det EOD, San Francisco, CA; Detachment NCO; Supervised 18 personnel, directed and performed the EOD mission of 150 EOD incidents per year in Northern California along with range work at Ft. Ord & Camp Roberts.
- Sep 87 - Aug 93 EOD Supervisor, Operations NCO E-8; 168th Ord Det EODCT, Mannheim, Germany; Written command directives on safety in EOD Opns involving ACRs and Range Clearances. Involved directly in EOD Operations; chemical, nuclear and conventional.
- Aug 93 - Oct 94 EOD Supervisor, 17th Ord Det EOD, Ft. Campbell, KY; Detachment NCO supervised 27 personnel; performed EOD operations in TN and KY. Responded to incidents at FUDS in KY and directed small range clearance Opns at Ft. Campbell.

- May 95 - Aug 95 UXO Supervisor, UXB International, Raritan Arsenal, NJ. In charge of a brush crew that cleared 31 acres of swamp and location of ordnance items: 37mm HE, adapter boosters, U.S. and French hand grenades.
- Aug. 95 - Apr. 96 UXO Supervisor, CMS, Environmental, Inc., Fort Ord, CA. Team leader in charge of a brush crew that cleared 314 grids without any OE accidents. Also responsible for the location and identification of ordnance items which included 22mm and 14.5mm subcaliber rounds, rockets, and mortars.
- Apr. 96 - Aug. 96 Project Manager, CMS Environmental, Inc., George Air Force Base (AFB), Victorville, CA. Managed an ordnance remediation job site at George AFB. Successfully cleared three areas consisting of 318 100x100 foot grids, including a 40mm grenade range, with no lost time accidents. Managed a workforce of 14 UXO technicians. Responsible for a \$490,000 programmed budget, including per diem and purchased and/or leases of supplies and equipment. Responsible for producing daily, weekly, and monthly reports and coordination with the BRAC office, Bureau of Prisons, and the Victorville Economic Development Agency. Safely completed all task order objectives two weeks ahead of schedule and under projected cost estimates. All work was accepted by the US Army Corps of Engineer's site representative on the first inspection.
- Aug. 96 - Dec. 96 Project Manager, CMS Environmental, Inc., Camp Elliott, East Elliott, CA. Successfully completed an EE/CA project consisting of 101 sampling grids within a 3,200 acre FUDS site, ahead of schedule, under projected cost estimates, and with no lost time accidents. Managed a workforce of 14 UXO technicians, five laborers, and one clerk typist. Responsible for producing daily, weekly, and monthly reports.
- Jan 97 – Jul 98 Project Manager, CMS Environmental, Inc., Fort Ord, CA. Managed an ordnance remediation project of 29.5 million dollars. The work involved the preparation of monthly Cost and Schedule Status Reports. During the performance of the contract no accidents occurred in the performance of work with explosives or vehicles. Participated in weekly and monthly meetings with the Corps of Engineers and the Installation to make decisions on the progress of the work and future sampling and removal actions this included public meetings to brief on the status of the contract.
- Jul 98 – Dec 00 Project Manager, USA Environmental, Inc., Fort Ord, CA. Managed an ordnance remediation project of 29.5 million dollars. The work involved the preparation of monthly Cost and Schedule Status Reports. During the performance of the contract no accidents occurred in the performance of work with explosives or vehicles. Participated in weekly and monthly meetings with the Corps of Engineers and the Installation to make decisions on the progress of the work and future sampling and removal actions this included public meetings to brief on the status of the contract.
- Jan 01 – Present Project Manager, USA Environmental, Inc., Tampa, FL. Responsible for the planning, scheduling, oversight and cost estimating of UXO support operations at the former Fort Ord, CA, Fort McClellan, AL, Benicia, CA, and Sioux Army Ammunition Depot, NE. Project Manager for the

Frankford Arsenal EE/CA in Philadelphia, PA a small (110 acres) but complex EE/CA being performed in the City of Philadelphia and the States of Pennsylvania and New Jersey. Assists USA Environmental Marketing in preparing responses to requests for proposal from US Army Corps of Engineers, AFCEE and NavFAC. Prepared and presented presentations on UXO operations at the former Fort Ord, California for the 2000 UXO Forum and the 2001 Louisville Corps of Engineers District Ordnance and Explosives Conference. Scheduled as a presenter of a case study at this year's UXO Forum in Orlando, FL. He presented a case study at the September 2002 UXO Forum in Orlando, FL.



**Education** B.S., Electrical Engineering, Lowell Technological Institute, 1973

**Professional Training**

- ROV Operation, Maintenance, and Training for Hydro Product's RCV 225 and ADROV, 1984
- 40-Hour Hazardous Waste Site Workers (HWSW) Basic Health and Safety Course, 1991
- 8-Hour Supervisor's Course on Health and Safety for Hazardous Waste Site Workers, 1992
- 8-Hour Annual HWSW Refresher – 2003
- Current CPR and First Aid Training

**Professional Experience**

**2001 – Present USA Environmental, Incorporated – Tampa, Florida**

As Senior Geophysicist, Mr. Crandall manages USA's geophysical capabilities including in-house resources and management of geophysical subcontractors. Serves as the primary technical point of contact for geophysical data, information, and support. Responsible for the oversight of planning, execution, analysis, relocation, and reporting of all geophysical surveys at OE Remediation, Construction Support, and EE/CA project sites. Drafts, reviews, and finalizes Geophysical Prove-Out (GPO) Work Plans, GPO Letter Reports, the Geophysical Investigation Plan, and Final Reports. Collaborates with other professionals and managers to ensure valid data quality objectives, procedures, and equipment are utilized on projects to generate and document reliable data. Has held field positions as Project Manager, Project Geophysicist, Site Geophysicist, and Technical Engineering and Field Support Manager during tenure at USA Environmental, Inc. Continually reviews designs throughout the project cycle to ensure designs specifications and successful systems integration are achieved. Also responsible for the development of innovative technologies to support OE operations. Current innovative technologies include: Meandering Path Geophysical Mapping at former Fort Ord; Development and demonstration of combined/concurrent magnetometer array and pulsed electromagnetic array on a common tow platform; Development of Automated Tools on a Handheld PC for OE Safety Field Operations and Quality Control; Development and demonstration of a Remote Excavator for heavily contaminated UXO sites; and the Development and evaluation of a Quality Assurance Instrument for OE QA field personnel.

**1986 – 2001 GEO-CENTERS, Inc. – Newton Center, Massachusetts**

As Senior Electronics Engineer and Geophysical Projects Manager, Mr. Crandall lead a team of multi-disciplined engineers in the development, testing, delivery and service of geophysical systems for land-based UXO detection and mapping. These systems included towed and man-portable arrays of total field magnetometers and/or pulsed electromagnetic induction sensors, integrated with Differential GPS. Provided UXO and

HTRW detection services with these systems in seventeen states and in Germany. Managed Multisensor Data Fusion algorithm development and testing for improved landmine detection, resulting in improved detection probability and lower false alarms. Transitioned a Ground Penetrating Radar Ordnance Search System from concept to fielded prototype. Deployed prototype at Government selected sites. Contributed to GEO-CENTERS' patented Energy Focusing Ground Penetrating Radar (EFGPR) used for vehicular mounted mine detection systems. The mine detection system integrated automatic target reports from a forward looking Infrared camera, an array of EM all-metals detectors, and an array of EFGPR, all positioned with real time kinematic differential GPS. Tested initial EFGPR at government sponsored tests.

**1973 – 1986**

**Naval Explosive Ordnance Disposal Technology Division – Indian Head, Maryland**

As Project Manager, Mr. Crandall designed, tested, and achieved approval for service use, tools to support the Explosive Ordnance Disposal mission including non-magnetic diving equipment (e.g. MK16 non-magnetic rebreather), diver-held UXO sensors (e.g. diver held magnetometer), towed UXO sensors and integrated positioning systems (including side scan sonar and total field magnetometers), and remotely operated vehicles (e.g. Italy's Pluto and the US ADROV). Mr. Crandall gained proficiency in the use of most commercially available man-portable UXO detection systems. He actively participated in a variety of Government field operations including the clearance of the Suez Canal and the Mediterranean approach to the canal, Port Breakout exercises on the east coast, west coast, and Hawaii, project Technical and Operational Evaluations, and underwater surveys for a lost NASA camera and a downed F16.

**ROBERT D. CROWNOVER****CORPORATE HEALTH & QUALITY MANAGER**

Date Completed Basic EOD School: August 1978

Never been removed from an EOD/UXO assignment for personnel reliability.

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**EOD/UXO Assignments:**

- Aug 78 - Apr 80 EOD Technician, 45th EOD, Ft. Polk, LA. Team member who assists in locating, identifying, removal & destruction of munitions. Member of range clearance team. Assisted in classroom & practical instruction.
- Apr 80 - Jun 83 EOD Technician, 72nd EOD, Bremerhaven, Germany. Team member who assists in determining and implementing render safe & disposal procedures. Range safety NCO. Assisted in training EOD and non-EOD personnel.
- Jun 83 - Sep 87 EOD Supervisor, 60th EOD, Ft. Dix, NJ. Assumed command of an EOD Team. Determined render safe and disposal procedures. Performed administrative functions. Supervised other EOD personnel. Conducted range operations.
- Sep 87 - May 90 EOD Instructor, EOD Trg. Det #1, Eglin AFB, Florida. Taught courses in ordnance recovery, protection of personnel and property safety, ORD. ID, and access and recovery. Testing of applied instructions. Drafting, finalizing and implementing testing criteria.
- May 90 - Sep 90 EOD Supervisor, 52nd EOD, Pine Bluff, AR. Team leader during EOD operations. Range Safety NCO. Conducted training in EOD related matters. Conducted range operations. Performed administrative functions.
- Sep 90 - May 91 EOD Supervisor, 16th EOD, Camp Darby, IT. Team leader during EOD operations. Assist in determining and implementing policy. Range NCO. Safety NCO. Training of other EOD & non-EOD personnel. Regulated administrative functions.
- May 91 - Dec 91 EOD Supervisor, 137th EOD, Ft. Sam, Houston, TX. Assumed command of an EOD team. Conducted range safety classes. Conducted training in EOD related matters. Determined render safe and disposal procedures Security functions.
- Mar 93 - Sep 94 UXO Supervisor, CMSI, Kuwait. Team member on minefield team. Conducted sweep, demolition and bunker operations. Field supervisor for 213 Third Country Nationals (TCN), 4 EOD technicians. Conducted training for TCN. Supervised disposal operations.
- Aug 95 – Jun 96 UXO Specialist, CMS Environmental, Inc., Fort Ord, CA. UXO Team member of a BRAC clearance and removal action.
- Jun 96 – Sep 96 UXO Supervisor, CMS Environmental, Inc., Ft. Ord, CA. Sampling and removal of OEW.

Sep 96 – Jul 98	Site Safety Officer, CMS Environmental, Inc., Ft. Ord, CA. Responsible for the overall safety of the project personnel and compliance with the Site Safety and Health Plan.
Jul 98 – Nov 99	Site Safety Officer, USA Environmental, Inc., Ft. Ord, CA. Responsible for the overall safety of the project personnel and compliance with the Site Safety and Health Plan.
Nov 99 – Present	Corporate Safety & Health Manager/Quality Control Manager, USA Environmental, Inc., Tampa, FL. Responsible for the development and implementation of USA's Safety and QC programs and plans. Performs project site inspections and audits to ensure compliance with requirements and standards. Reviews draft and final work plans, reports, and associated documents for accuracy, completeness, and content. Interfaces with agencies on safety, health, and/or quality issues at the corporate or job site levels.

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## APPENDIX I      TECHNICAL PROJECT PLANNING WORK SHEETS

The project team developed the following worksheets in advance of the Phase I and II Technical Project Planning Meeting to aid the development of project goals and objectives. The project team will incorporate changes as additional information is provided throughout the Technical Project Planning of this Ordnance and Explosives Engineering Evaluation/Cost Analysis. The project team developed these worksheet based on USAESCH Interim Guidance for Technical Project Planning.



## Conceptual Site Model

Site	Acreage	Site Type	Past DoD Activities	OE Found Since Closure	Post-DoD Land Use and Current Land Use	PRP Involvement	TPP Recommendations Geophysical Investigations
<b>Sector 15</b>	11,241	Potential OE Disposal	Portions of the sector are within the original boundary of the maneuver area. Reports and previous investigations indicate use and disposal of OE in adjacent areas of the maneuver area.	None in sector. UXO found in adjacent areas.	Residential and Cattle Grazing. Mostly undeveloped.	Part of the original maneuver area from 1943 to 1946. Potential unauthorized disposal of ordnance by military personnel.	Area of potential concern. Include area in the instrument-assisted ground reconnaissance and digital geophysical survey of the former Waikoloa Maneuver Area because of UXO discoveries in adjacent areas. Evaluate geophysical data to determine if intrusive operations are required in this area.
<b>Sector 16</b>	3,000	Potential OE Disposal	DoD used western portions of the sector as transport routes (tank and heavy equipment trails). Previous investigations indicate use and disposal of OE in adjacent military maneuver areas.	None in sector. UXO found in adjacent areas.	Residential and Cattle Grazing. Mostly undeveloped.	DoD used western portions of the sector as transport routes (tank and heavy equipment trails). No other documented activities in sector.	Area of potential concern. Include area in the instrument-assisted ground reconnaissance and digital geophysical survey of the former Waikoloa Maneuver Area because of UXO discoveries in adjacent areas. Evaluate geophysical data to determine if intrusive operations are required in this area.
<b>Sector 17</b>	2,500	Potential OE Disposal	Portions of the sector are within the original boundary of the Lalamilo Firing Range. Previous investigations indicate use and disposal of OE in adjacent military maneuver areas.	None in sector. UXO found in adjacent areas.	Residential, Resort, State Lands. Mostly developed.	Part of the original Lalamilo Firing Range from 1943 to 1953. Potential unauthorized disposal of ordnance by military personnel.	Area of potential concern. Include area in the instrument-assisted ground reconnaissance and digital geophysical survey of the former Waikoloa Maneuver Area because of UXO discoveries in adjacent areas. Evaluate geophysical data to determine if intrusive operations are required in this area.





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**Technical Project Planning  
Phase 1 MFR Worksheet**

Author(s): D. Ralston and D. Synakorn  
Latest Revision Date: 10 OCT 03

Reviewer:  
Review Date:

Location: Former Waikoloa Maneuver Area, Island of Hawaii, Hawaii  
Site: Sector 15, Sector 16, and Sector 17  
Project: Phase III OE Engineering Evaluation/Cost Analysis (EE/CA)

(Attach Phase 1 MFR to PMP)

**TPP TEAM**

**EM 200-1-2, Paragraph 1.1.1**

<b>Decision Maker</b>	U.S. Army Corps of Engineers (USACE)	
<b>Customer:</b>	USACE Honolulu District U.S. Army Engineering and Support Center, Huntsville (USAESCH)	
<b>Project Manager:</b>	Charles Streck, USACE Honolulu District Robert Nore, USAESCH	
<b>Regulator(s):</b>	U.S. Environmental Protection Agency (USEPA) Region IV	
<b>Stakeholders:</b>	Restoration Advisory Board (RAB) Property Owners Waikoloa, Kohala, and Waimea Community	
<b>Data Types</b>	<b>Data User</b>	<b>Data Gatherer</b>
Compliance/Regulatory (CR)	USAESCH, USACE Honolulu District, Regulators	USA Environmental
Demographics/Land Use (LU)	USAESCH, USACE Honolulu District	USA Environmental
Site Conditions (SC)	USAESCH, USACE Honolulu District	USA Environmental
OE/UXO (UXO)	USAESCH	USA Environmental

<b>CUSTOMER'S GOALS</b>		<b>EM 200-1-2, Paragraph 1.1.2</b>
<b>Land Use(s)</b>	<b>Issues and Regulatory Compliance Status</b>	<b>Interim Site Close out Goal (if applicable)</b>
<b>Sector 15</b> Hawaiian Homelands Current: Residential, Cattle Grazing Future: Residential, Cattle Grazing	No known OE contamination. However, the area is part of the former Waikoloa Maneuver Area. Phase I and Phase II OE EE/CA have identified OE contamination in adjacent areas.	Land is safe for continued use by property owners
<b>Sector 16</b> Current: Residential, Cattle Grazing Future: Residential, Cattle Grazing	No known OE contamination. However, the area is part of the former Waikoloa Maneuver Area. Phase I and Phase II OE EE/CA have identified OE contamination in adjacent areas.	Land is safe for continued use by property owners
<b>Sector 17</b> Current: Residential, Resorts Future: Residential, Resorts	No known OE contamination. However, the area is part of the former Waikoloa Maneuver Area. Phase I and Phase II OE EE/CA have identified OE contamination in adjacent areas.	Land is safe for continued use by property owners
<b>Site Closeout Statement</b>		
Land is safe for intended use after performing EE/CA activities and implementation of the most appropriate OE response action alternative. Unrestricted use for areas that have no historical OE use or burial. Land Use Controls and or construction support for areas that contain burial pits or OE use.		
<b>Customer's Schedule Requirements</b>		
Phase III EE/CA Field Investigation February and March 2004 Final Phase III EE/CA Report September/October 2004 Action Memorandum October/November 2004		
<b>Customer's Site Budget</b>		
EE/CA Field Investigation and Reporting: \$581,694.00		

<b>IDENTIFY SITE APPROACH</b>		
<b>EXISTING SITE INFORMATION AND DATA</b>		<b>EM 200-1-2, Paragraphs 1.1.3 and 1.2.1</b>
<b>Attachment(s) to Phase 1 MFR</b>	<b>Located at Repository</b>	<b>Preliminary Conceptual Site Model</b>
Archive Search Report	No	No
Site Prioritization Report	No	No
Phase I OE EE/CA Report	Yes	Yes
Phase II OE EE/CA Report	Yes	Yes
<b>POTENTIAL POINTS OF COMPLIANCE</b>		<b>EM 200-1-2, Paragraph 1.2.1.3</b>
Most Probable Munition for Each Project Site for the Explosive Safety Submission		
<b>MEDIA OF POTENTIAL CONCERN</b>		<b>EM 200-1-2, Paragraph 1.2.1.4</b>
OE/UXO in Surface and Subsurface Soil		
<b>SITE OBJECTIVES</b>		<b>EM 200-1-2, Paragraph 1.2.2</b>
Site Closeout		
<i>See Attached Worksheets Developed by USAESCH and USA Environmental</i>		
<b>REGULATOR AND STAKEHOLDER PERSPECTIVES</b>		<b>EM 200-1-2, Paragraph 1.2.3</b>
<b>Regulators</b>	<b>Community Interests</b>	<b>Others</b>
Potential receptors	Land is safe for intended use	Reporting procedures if suspect UXO found
Phased or incremental Closeout if possible	Activities performed do not suffer because of uncertainty about OE risk	
	Recurring reviews do not raise questions about OE risk every few years	
<b>PROBABLE REMEDIES</b>		<b>EM 200-1-2, Paragraph 1.2.4</b>
Detonation of suspect UXO/OE as found during investigations and Removal Actions		
Removal of residual OE scrap from the project site		
<b>EXECUTABLE STAGES TO SITE CLOSEOUT</b>		<b>EM 200-1-2, Paragraph 1.2.5</b>
Phase III OE Engineering Evaluation/Cost Analysis		
<ul style="list-style-type: none"> <li>• Site Visit and Geophysical Prove-Out</li> <li>• Instrument-Assisted Ground Reconnaissance</li> <li>• Digital Geophysical Mapping and Intrusive Geophysical Investigation</li> <li>• Qualitative OE Risk Evaluation and Response Alternative Evaluation</li> <li>• Final Phase III OE EE/CA Report Submission</li> </ul>		
Time-Critical Removal Action (as required)		
Action Memorandum		
Conventional Ordnance Explosive Safety Submission (as needed)		
Removal Actions (as needed)		

<b>IDENTIFY CURRENT PROJECT</b>		
<b>SITE CONSTRAINTS AND DEPENDENCIES</b>		<b>EM 200-1-2, Paragraph 1.3.1</b>
<b>Administrative Constraints and Dependencies</b>		
Funding		
RAB Involvement and Notification		
Rights of Entry		
<b>Technical Constraints and Dependencies</b>		
Environmental Constraints (e.g., basalt, lava rocks, heavy vegetation)		
Geophysical Instrument Interference (i.e., basalt background noise)		
Leaseholder Site Activities (e.g., Exclusion Zones, Site Access)		
<b>Legal and Regulatory Milestones and Requirements</b>		
Consistent with CERCLA and NCP		
Public, Stakeholder, and Regulatory Involvement and Review of Key Documents		
FUDS Funding Limitations		
<b>CURRENT EXECUTABLE STAGE</b>		<b>EM 200-1-2, Paragraph 1.3.3</b>
EE/CA Site Investigation and Development		
<i>See Attached Worksheets Developed by USAESCH and USA Environmental</i>		
<b>Basic</b> (For Current Project)	<b>Optimum</b> (For Future Projects)	<b>Excessive</b> (Objectives that do not lead to site closeout)
<i>Varies by Project Site – See Objectives Worksheet</i>	<i>Varies by Project Site – See Objectives Worksheet</i>	<i>Varies by Project Site – See Objectives Worksheet</i>

## Acronyms

CERCLA	Comprehensive Environmental Restoration, Compensation, and Liability Act
EE/CA	Engineering Evaluation/Cost Analysis
FUDS	Former Used Defense Sites
MFR	Memorandum for Record
NCP	Funding Limitations
OE	Ordnance and Explosives
PMP	Project Management Plan
RAB	Restoration Advisory Board
USEPA	U.S. Environmental Protection Agency
UXO	Unexploded Ordnance

**PROJECT OBJECTIVES WORKSHEET**

**SITE:** Former Waikoloa Maneuver Area (Sectors 15, 16, 17), Island of Hawaii, Hawaii

**PROJECT:** Phase III Ordnance and Explosive (OE) Engineering Evaluation/Cost Analysis (EE/CA)

Site Objectives						
Number	Executable Stage		Description	Data Needs	Data Collection Methods	Project Objective Classification
	Current	Future				
1	Yes		Geophysical Prove-Out	OE, LU, CR, SC	Testing/selection of appropriate digital geophysical instruments.	<input checked="" type="checkbox"/> Basic <input type="checkbox"/> Optimum <input type="checkbox"/> Excessive
2	Yes		Delineate OE within Sector	OE	<ul style="list-style-type: none"> <li>• Historical analysis and document review</li> <li>• Instrument-assisted ground reconnaissance</li> <li>• Digital geophysical survey</li> <li>• Intrusive investigation (if needed)</li> </ul>	<input checked="" type="checkbox"/> Basic <input type="checkbox"/> Optimum <input type="checkbox"/> Excessive
3	Yes		Impact Analysis/OERIA	OE, LU	Qualitative risk analysis	<input checked="" type="checkbox"/> Basic <input type="checkbox"/> Optimum <input type="checkbox"/> Excessive
4	Yes		Alternatives Evaluation and Recommendation	OE, LU, CR, SC	EE/CA Report	<input checked="" type="checkbox"/> Basic <input type="checkbox"/> Optimum <input type="checkbox"/> Excessive
5		Yes	NDAI/RA Decision	OE, LU	EE/CA Action Memorandum	<input checked="" type="checkbox"/> Basic <input type="checkbox"/> Optimum <input type="checkbox"/> Excessive

**Acronyms**

- CR Compliance/Regulatory
- LU Land Use/Demographics
- OE Ordnance and Explosives
- SC Site Conditions
- EE/CA Engineering Evaluation/Cost Analysis
- NDAI No Department of Defense Action Indicated
- RA Removal Action





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## Technical Project Planning Data Quality Objectives Worksheet

Author(s): D. Ralston and D. Synakorn

Reviewer:

Latest Revision Date: 24 OCT 03

Review Date:

Location: Former Waikoloa Maneuver Area, Island of Hawaii, Hawaii

Site: Sector 15, Sector 16, and Sector 17

Project: Phase III OE Engineering Evaluation/Cost Analysis (EE/CA)

### Data Quality Objective 1:

Intended data use:	To define current and future land use (TPP Objective 1) To perform impact analysis/OERIA (TPP Objective 3)
Data need requirement:	Current and future land access, development, and use
Data category:	Basic
Quantity of data:	Sufficient data to characterize current and projected human activity in the areas of concern
Data collection method:	Coordination of TPP for the OE EE/CA of the former Waikoloa Maneuver Area
DQO met?:	

### Data Quality Objective 2:

Intended data use:	To delineate OE within project site (TPP Objective 2)
Data need requirement:	OE potential within areas of concern
Data category:	Basic
Quantity of data:	Any presence of OE on the surface or subsurface of the areas of concern
Data collection method:	site visits, TPP, interviews, historical analysis, instrument-assisted ground reconnaissance, geophysical mapping of grids based on reconnaissance, intrusive investigation (as needed, based on geophysical mapping)
DQO attained?:	

### Data Quality Objective 3:

Intended data use:	To perform impact analysis/OERIA (TPP Objective 3)
Data need requirement:	OE potential within areas of concern
Data category:	Basic
Quantity of data:	Any presence of OE on the surface or subsurface of the areas of concern
Data collection method:	site visits, TPP, interviews, historical analysis, instrument-assisted ground reconnaissance, geophysical mapping of grids based on reconnaissance, intrusive investigation (as needed, based on geophysical mapping)
DQO attained?:	

<b>Data Quality Objective 4:</b>	
Intended data use:	NDAI/RA decision (TPP Objective 4)
Data need requirement:	OE risk within areas of concern
Data category:	Basic
Quantity of data:	Any presence of OE on the surface or subsurface of the areas of concern, or data to support decision of No DoD Action Indicated or appropriate Removal Actions
Data collection method:	OERIA
DQO attained?:	

## Acronyms

EE/CA	Engineering Evaluation/Cost Analysis
DQO	Data Quality Objective
OE	Ordnance and Explosives
OERIA	Ordnance and Explosives Risk Impact Assessment
NDAI	No Department of Defense Action Indicated
RA	Removal Action
TPP	Technical Project Planning

**APPENDIX J    FORMS**



**DAILY OPERATIONS SUMMARY**

**DATE:** \_\_\_/\_\_\_/\_\_\_

**PAGE** \_\_\_ **OF** \_\_\_ **PAGES**

**SITE / LOCATION:** \_\_\_\_\_

**1. WORK SUMMARY**

<b>a. Work Accomplished:</b>	<b>Number Completed</b>	<b>Total Remaining</b>
(1) Survey	_____	_____
(2) Preparation	_____	_____
(3) Mag & Flag	_____	_____
(4) Geophysical	_____	_____
(5) Intrusive	_____	_____
(6) Quality Control	_____	_____
(7) Quality Assurance	_____	_____

**b. Discrepancies:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

<b>c. Inspection Results:</b>	<b>Pass</b>	<b>Fail</b>
(1) Quality Control	_____	_____
(2) Quality Assurance	_____	_____
(3) Safety	_____	_____

**2. INSTRUCTIONS RECEIVED FROM CUSTOMER REPRESENTATIVE:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_







Daily Operations Summary Con't.

PAGE \_\_\_ of \_\_\_ PAGES

**b. Daily Equipment:**

Description:	Task:	Hours Used:	Hours Remaining:	% Hours Remaining:	Remarks:
Schonstedt					
Geophysical					
Truck (Heavy)					
Truck (Light)					
Radio, Base					
Radio, Handheld					
Backhoe					
Front-end Loader					
Rental Car					
GPS					
Weedeater					
Chainsaw					
Chipper					

**5. Operational Remarks:**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**6. Signature / Date:**

\_\_\_\_\_

SUXO / Project Manager

Date: \_\_\_/\_\_\_/\_\_\_

**USA ENVIRONMENTAL, INC. EMPLOYEE INJURY REPORT**Site/Location: \_\_\_\_\_ **Control Number:** \_\_\_\_\_*This is an official document to be initiated by USA supervisors. Be accurate, thorough, and answer all questions.***BACKGROUND DATA**

Today's Date: \_\_\_\_/\_\_\_\_/\_\_\_\_ Date of Accident: \_\_\_\_/\_\_\_\_/\_\_\_\_ Time: \_\_\_\_\_ AM PM

Day of Accident: S M T W T F S Weather Conditions: Sunny Clear Rain Fog Overcast

Temperature: 0-32 32-50 50-70 70-85 85 + Wind Conditions: Still Moderate High None

Location of Accident: \_\_\_\_\_ Time Accident was Reported: \_\_\_\_\_ AM PM

Reported to Whom: \_\_\_\_\_

**PERSONAL DATA**

Name: Last \_\_\_\_\_ First \_\_\_\_\_ MI \_\_\_\_\_

Sex: F M DOB: \_\_\_\_/\_\_\_\_/\_\_\_\_ Place of Birth: \_\_\_\_\_

SSAN: \_\_\_\_-\_\_\_\_-\_\_\_\_ DOH: \_\_\_\_/\_\_\_\_/\_\_\_\_ Position: \_\_\_\_\_

Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_

Telephone Number: (\_\_\_\_) \_\_\_\_-\_\_\_\_ Zip: \_\_\_\_\_

**ACCIDENT DATA**Nature of Accident: Near Miss \_\_\_\_ 1<sup>st</sup> Aid \_\_\_\_ Dr Visit \_\_\_\_ Ambul \_\_\_\_ Hospitalized \_\_\_\_ Fatality \_\_\_\_

If Fatality, Name of Agency Notified: \_\_\_\_\_ Type of Injury: \_\_\_\_\_

Did Employee Leave the Work Site: Yes \_\_\_\_ No \_\_\_\_ If Yes, Time Departed: \_\_\_\_\_ AM PM

Name of Medical Facility: \_\_\_\_\_ Telephone Number: (\_\_\_\_) \_\_\_\_-\_\_\_\_

Address: \_\_\_\_\_ City: \_\_\_\_\_ State: \_\_\_\_ Zip: \_\_\_\_\_

Description of Accident: \_\_\_\_\_

Activity at Time of Accident: \_\_\_\_\_

**Employee Injury Report Con't.**

<b>WITNESS DATA</b>			
Witness Name: Last _____	First _____	MI _____	
Address: _____		City: _____	State: ____ Zip: _____
Telephone Number: (____) ____ - ____		Employed By: _____	
Statement Attached: Yes ___ No ___		Telephone Number: (____) ____ - ____	

<b>ACCIDENT ACTIONS/ANALYSIS</b>	
Accident Cause(s): _____ _____	
Lack of Safety Equipment a Factor: Yes ___ No ___ If Yes, Explain: _____ _____	
Safety Regulations or Guidance Violated: Yes ___ No ___ If Yes, Explain: _____ _____	
Photographs Taken: Yes ___ No ___ If Yes, Located at: _____	
Regulatory Agencies Notified: Yes ___ No ___ If Yes, which: _____	
Point of Contact: _____	Date and Time: ____/____/____ ____ AM PM
Corrective Actions Taken or Recommended: _____ _____	
Report Prepared By: _____	Signature: _____

<b>SUXO/PROJECT MANAGER</b>	
Corrective Actions/Recommendations: _____	
SUXO Signature: _____	Date: ____/____/____
Concur With Actions Taken: Yes ___ No ___ Remarks: _____	
Project Manager Signature: _____	Date: ____/____/____



**DAMAGED EQUIPMENT/VEHICLE ACCIDENT REPORT CON'T:**

CONTROL NUMBER: \_\_\_\_\_

INSURANCE FILE #: \_\_\_\_\_

VENDOR FILE #: \_\_\_\_\_

**EQUIPMENT/VEHICLE DESCRIPTION**

OWNERS NAME AND TELEPHONE NUMBER (ie; Hertz, COE, US Rentals): \_\_\_\_\_

EQUIPMENT/VEHICLE DESCRIPTION ( include make, model, type, etc.): \_\_\_\_\_

IDENTIFICATION NUMBER(S) (ie; VIN, serial, license, Government/company ID number(s): \_\_\_\_\_

DESCRIBE NATURE OR EXTENT OF DAMAGE: \_\_\_\_\_

HOW WOULD YOU CLASSIFY THE DAMAGE?  SUPERFICIAL  MINOR  MAJOR

**SUPPORTING DOCUMENTATION**

HAS A POLICE REPORT BEEN FILED?  YES  NO

IF YES, POLICE REPORT NUMBER: \_\_\_\_\_

IS POLICE REPORT ATTACHED?  YES  NO

IF NO, WHEN WILL POLICE REPORT BE AVAILABLE? \_\_\_\_\_

POLICE TELEPHONE NUMBER: \_\_\_\_\_

ARE WITNESS STATEMENTS AVAILABLE?  YES  NO

IF YES AND NOT ATTACHED EXPLAIN: \_\_\_\_\_

**DAMAGED EQUIPMENT/VEHICLE ACCIDENT REPORT CON'T:**

CONTROL NUMBER: _____ INSURANCE FILE #: _____ VENDOR FILE #: _____
--

<b>ANALYSIS</b>
WERE SAFETY REGULATIONS, GUIDANCE, POLICIES, OR LAWS VIOLATED? ____ YES ____ NO IF YES, EXPLAIN: _____ _____ _____ _____
PHOTOGRAPHS TAKEN? ____ YES ____ NO IF YES, LOCATION OF PHOTOGRAPHS: _____ _____
CORRECTIVE ACTIONS/RECOMMENDATIONS TO BE TAKEN/IMPLIMENTED: _____ _____ _____ _____
IDENTIFY ANY SUPPORTING/ADDITIONAL DOCUMENTS: _____ _____
ANALYSIS PREPARED BY: _____ DATE: ____/____/____
SIGNATURE: _____

SENIOR UXO SUPERVISOR: RECOMMENDATIONS: _____ SIGNATURE: _____ DATE: ____/____/____
USA PROJECT MANAGER: CONCUR WITH ACTIONS/RECOMMENDATIONS: ____ YES ____ NO REMARKS: _____ SIGNATURE: _____ DATE: ____/____/____
<b>DAMAGED EQUIPMENT/VEHICLE ACCIDENT REPORT CON'T:</b>

CONTROL NUMBER: _____ INSURANCE FILE #: _____ VENDORS FILE #: _____
---

<b>REPAIR/REPLACEMENT DATA</b>	
ESTIMATED COST OF REPAIR: _____	DOWN TIME: _____
ESTIMATED COST OF REPLACEMENT: _____	REPLACE TIME: _____
INSURANCE CLAIM FILED? <input type="checkbox"/> YES <input type="checkbox"/> NO	IF YES, DATE: ____/____/____
IS THIS A PAY DIRECT? <input type="checkbox"/> YES <input type="checkbox"/> NO	AMOUNT: _____
DATE DEDUCTIBLE PAID: ____/____/____	AMOUNT: _____
DATE VENDOR PAID: ____/____/____	AMOUNT: _____
DATE INSURANCE PAID: ____/____/____	AMOUNT: _____
DATE CLOSED: ____/____/____	
SUPPORTING DOCUMENTS ATTACHED? <input type="checkbox"/> YES <input type="checkbox"/> NO	
IF YES, IDENTIFY: _____	
_____	
_____	
COMMENTS: _____	
_____	
_____	

REVIEWED BY: SIGNATURE _____
NAME _____
TITLE/POSITION _____ DATE: ____/____/____
APPROVED BY: SIGNATURE _____
NAME _____
TITLE/POSITION _____ DATE: ____/____/____

USA Environmental, Inc.	
<b>TAILGATE SAFETY BRIEFING</b>	
<b>Date:</b>	____/____/____
<b>Location:</b>	_____
<b>Time:</b>	_____ AM PM <b>Team #:</b> _____

<b>1. Reason for Briefing:</b>			
<input type="checkbox"/>	Daily Safety Briefing	<input type="checkbox"/>	New Site Procedure
<input type="checkbox"/>	Initial Safety Briefing	<input type="checkbox"/>	New Site Information
<input type="checkbox"/>	New Task Briefing	<input type="checkbox"/>	Review of Site Information
<input type="checkbox"/>	Periodic Safety Meeting	<input type="checkbox"/>	Other: (Specify)
<b>2. Personnel Attending:</b>			
	Name	Signature	Position
<b>Briefing Given By:</b>			
<b>3. Topics: ( Check All That Apply )</b>			
<input type="checkbox"/>	Site Safety Personnel	<input type="checkbox"/>	Decontamination Procedures
<input type="checkbox"/>	Site/Work Area Description	<input type="checkbox"/>	Emergency Response/Equipment
<input type="checkbox"/>	Physical Hazards	<input type="checkbox"/>	On-Site Injuries/Illnesses
<input type="checkbox"/>	Chemical/Biological Hazards	<input type="checkbox"/>	Reporting Procedures
<input type="checkbox"/>	Heat/Cold Stress	<input type="checkbox"/>	Directions to Medical Facility
<input type="checkbox"/>	Work/Support Zones	<input type="checkbox"/>	Drug and Alcohol Policies
<input type="checkbox"/>	PPE	<input type="checkbox"/>	Medical Monitoring
<input type="checkbox"/>	Safe Work Practices	<input type="checkbox"/>	Evacuation/Egress Procedures
<input type="checkbox"/>	Air Monitoring	<input type="checkbox"/>	Communications
<input type="checkbox"/>	Task Being Performed	<input type="checkbox"/>	Confined Spaces
<input type="checkbox"/>	OE Precautions	<input type="checkbox"/>	Other:
<b>4. Remarks:</b>			



<b>USA Environmental Inc.</b>
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<b>Safety Meeting/Training Record Con't:</b>
--

<b>3. Topics Covered (Check all that apply)</b>		
<input type="checkbox"/>	Site Safety Personnel	<input type="checkbox"/> Decontamination Procedures
<input type="checkbox"/>	Site/Work Area Description	<input type="checkbox"/> Emergency Response Plan
<input type="checkbox"/>	Site Characterization	<input type="checkbox"/> Hazard Communities
<input type="checkbox"/>	Biological Hazard(s)	<input type="checkbox"/> On-Site Emergency
<input type="checkbox"/>	Chemical Hazard(s)	<input type="checkbox"/> On-Site Injuries/Illnesses
<input type="checkbox"/>	Physical Hazard(s)	<input type="checkbox"/> Evacuation Procedures
<input type="checkbox"/>	Heat Stress	<input type="checkbox"/> Rally Point(s)
<input type="checkbox"/>	Cold Stress	<input type="checkbox"/> Emergency Communication
<input type="checkbox"/>	Site Control	<input type="checkbox"/> Directions to Medical Facility
<input type="checkbox"/>	Work and Support Zones	<input type="checkbox"/> Drug and Alcohol Policies
<input type="checkbox"/>	PPE	<input type="checkbox"/> Medical Monitoring Program
<input type="checkbox"/>	Air monitoring	<input type="checkbox"/> Specific Task Training
<input type="checkbox"/>	Safe Work Practices	<input type="checkbox"/> Confined Spaces
<input type="checkbox"/>	Engineering Controls and Equipment	<input type="checkbox"/> Heavy Equipment
<input type="checkbox"/>	Spill Containment Procedures	<input type="checkbox"/> Other: (Specify)
<input type="checkbox"/>		
<b>4. Remarks:</b>		

**5. Verification:**

*I certify that the personnel listed above on this record received the Information and/or Training described as indicated. Personnel not attending this meeting/training will receive said information/training prior to commencing their assigned duties.*

\_\_\_\_\_  
**UXO Safety Officer**

**Date:** \_\_\_\_/\_\_\_\_/\_\_\_\_

**SAFETY INSPECTION REPORT**

**USA Environmental, Inc.**

Site / Location: \_\_\_\_\_

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_

Type of Inspection: \_\_\_\_ Daily \_\_\_\_ Weekly \_\_\_\_ Re-Inspection \_\_\_\_ Other

Type of Operation Inspected:

\_\_\_\_\_

\_\_\_\_\_

Equipment Inspected: ( Specify if Safety or Operational in Nature )

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Comments:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Deficiencies Found or Noted:

\_\_\_\_\_

\_\_\_\_\_

Corrective Action:

\_\_\_\_\_

\_\_\_\_\_

Re-Inspection Required: \_\_\_\_ Yes \_\_\_\_ No  
\_\_\_\_/\_\_\_\_/\_\_\_\_

If Yes, Date of Re-Inspection:

Signature: \_\_\_\_\_

Site Safety Officer

SUXO / Project Manager

\* Copy to Supervisor if Deficiencies or Corrective Action were found, noted or deemed necessary.

**USA Environmental, Inc.**

**DAILY QUALITY CONTROL REPORT**

Date: \_\_\_\_/\_\_\_\_/\_\_\_\_      Contract #: \_\_\_\_\_      **Task Order #:** \_\_\_\_\_

Site/Location : \_\_\_\_\_

Weather: \_\_\_\_\_      Temperature: \_\_\_\_\_      Rainfall: \_\_\_\_\_

**1. Preparatory Inspection:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Results: \_\_\_\_\_

**2. QC Audits Performed**

a. Operations: \_\_\_\_\_

\_\_\_\_\_

Results: \_\_\_\_\_

b. Safety: \_\_\_\_\_

\_\_\_\_\_

Results: \_\_\_\_\_

c. Administrative: \_\_\_\_\_

\_\_\_\_\_

Results: \_\_\_\_\_

d. Equipment: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Results: \_\_\_\_\_

\_\_\_\_\_

**Daily Quality Control Report Con't:**

**3. QC Performed (Grids)**

Number of Grids QC'd: \_\_\_\_\_ Results: \_\_\_\_\_ # Pass \_\_\_\_\_ # Fail

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**4. Follow Up Inspections and Results**

Section(s): \_\_\_\_\_  
\_\_\_\_\_

Results: \_\_\_\_\_

**5. Instructions Received:** \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Remarks:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**QC Signature:** \_\_\_\_\_

**Date:** \_\_\_\_/\_\_\_\_/\_\_\_\_

**Printed Name:** \_\_\_\_\_

**QC INSPECTION RECORD**

**USA Environmental, Inc.**

<b>Site/Location:</b> _____	<b>Date:</b> ____/____/____
<b>Grid Number:</b> _____	<b>Inspected By:</b> _____
<b>Start Time:</b> _____ AM PM	<b>Stop Time:</b> _____ AM PM

Personnel:			QC Results:			
Position	Name	Hours	Item	Yes	No	Quantity
QC Officer			OE Found			
UXO Tech III			Anomalies			
UXO Tech II						
UXO Tech I			Pass Insp.			

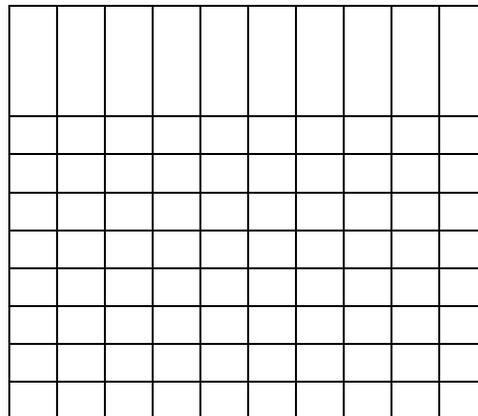
**Remarks:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Draw the approximate location of items that were answered Yes in QC Results.



**SW Corner of Grid**





<b>Explosives Usage Record</b>				<i>Contract Number:</i>
Team Number:		Date:	Project Name:	
Team Leader:		Work Areas & Grid Numbers:		
Explosives Issued		Signature Of Team Leader:		
Item	Quantity	Lot Number	Checkers Initials	
Explosives Expended		Signature Of Team Leader:		
Item	Quantity	Lot Number	Checkers Initials	
Explosives Returned		Signature Of QC Officer:		
Item	Quantity	Lot Number	Checkers Initials	
The signatures in each section of this document indicate that the items listed in that section were in fact issued, expended, or returned to storage and that the quantities listed were verified through a physical count.				

**EXPLOSIVES USAGE**

**USA Environmental, Inc.**

**EXPLOSIVE VEHICLE ON-SITE INSPECTION**

This form must be completed for any vehicle carrying explosives. This form is to be completed prior to loading and transporting explosives and is for On-Site use only, any travel over public roadways require the use of DD Form 626.

Project Location: \_\_\_\_\_ Date: \_\_\_/\_\_\_/\_\_\_

Driver Name: \_\_\_\_\_ License #: \_\_\_\_\_

Vehicle Type: \_\_\_\_\_ Vehicle ID #: \_\_\_\_\_

Inspected By: \_\_\_\_\_ Time: \_\_\_\_\_ AM PM

Item Inspected:	Sat.	Un-Sat.	Comment.
Horn	_____	_____	_____
Steering System	_____	_____	_____
Windshield Wipers	_____	_____	_____
Mirrors	_____	_____	_____
Vehicle Lighting	_____	_____	_____
Emergency Flashers	_____	_____	_____
Exhaust System	_____	_____	_____
Brake System	_____	_____	_____
Electrical Wiring	_____	_____	_____
Tires, Wheels & Rims	_____	_____	_____
Tailgate	_____	_____	_____
Fuel System	_____	_____	_____
Suspension System	_____	_____	_____
Fire Extinguishers (2 ea. 10-BC)	_____	_____	_____
Tarpaulin/Camper Shell	_____	_____	_____
Cargo Area	_____	_____	_____
1 <sup>st</sup> Aid Kit	_____	_____	_____

Inspection Results: \_\_\_\_\_ Accepted \_\_\_\_\_ Rejected \_\_\_\_\_

Remarks: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Drivers Signature: \_\_\_\_\_ Date: \_\_\_/\_\_\_/\_\_\_

Inspectors Signature: \_\_\_\_\_ Date: \_\_\_/\_\_\_/\_\_\_



**WEEKLY OPERATIONS SUMMARY**

**DATE:** \_\_\_\_/\_\_\_\_/\_\_\_\_

**PAGE** \_\_\_\_ **OF** \_\_\_\_ **PAGES**

**SITE / LOCATION:** \_\_\_\_\_

**2. WORK SUMMARY**

<b>a. Work Accomplished:</b>	<b>Number Completed</b>	<b>Total</b>
(1) Survey	_____	_____
(2) Preparation	_____	_____
(3) Mag & Flag	_____	_____
(4) Geophysical	_____	_____
(5) Intrusive	_____	_____
(6) Quality Control	_____	_____
(7) Quality Assurance	_____	_____

**b. Discrepancies:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

<b>c. Inspection Results:</b>	<b>Pass</b>	<b>Fail</b>
(1) Quality Control	_____	_____
(2) Quality Assurance	_____	_____
(3) Safety	_____	_____

**2. INSTRUCTIONS RECEIVED FROM CUSTOMER REPRESENTATIVE:** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_







Weekly Operations Summary Con't.

PAGE \_\_\_ of \_\_\_ PAGES

**b. Weekly Equipment:**

Description:	Task:	Hours Used:	Total Hours Used:	Hours Remaining:	% Hours Remaining:
Schonstedt					
Geophysical					
Truck (Heavy)					
Truck (Light)					
Radio, Base					
Radio, Handheld					
Backhoe					
Front-end Loader					
Rental Car					
GPS					
Weedeater					
Chainsaw					
Chipper					

**9. Remarks:**

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**10. Signature / Date:**

\_\_\_\_\_  
SUXO / Project Manager

Date: \_\_\_/\_\_\_/\_\_\_



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**GROUND RECONNAISSANCE CHECKLIST****Daily Start Operations****WHITE SPECTRUM XLT METAL DETECTOR**

- Check battery (New batteries at start of field operations)
- Daily Operational Check (Detection of Known Subsurface Seed Item)
- Record Serial Number in PDA (Log Book)
- Record Results in PDA (Log Book)

**TRIMBLE PATHFINDER PRO XRS ROVER GPS**

- Check Batteries (use charged batteries at the start of each day)
- Ensure Spare Batteries in Backpack (insure backup batteries are on charge)
- Assemble Antenna
- Connect and Turn on Data logger
- Compare Location at a Known Point (Record in Log Book; offsets >1.0m require repair)
- Record Serial Number in PDA (Log Book)
- 

**IPAQ 3700 PDA (ARCPAD GIS 6.0)**

- Charge batteries overnight
- Ensure extra batteries are charging (Located in Team Truck)
- Connect to GPS
- Open GIS file with Recon Guidance layer (verify current position on layer)
- Verify Track Log On

**CELL PHONE**

- Charge battery overnight
- Make Morning Check with Safety

**RADIO**

- Charge batteries overnight
- Make Morning Check with team members

**DIGITAL CAMERA**

- Ensure Two Batteries Charged
- Erase Previous Photographs

**Mid-Day operations**

All Equipment:

- Change batteries, if necessary
- Download and backup critical data

**Daily End Operations****WHITE SPECTRUM XLT METAL DETECTOR**

- Turn Instrument Off (New batteries at start of field operations)
- Record Results in PDA (Log Book)

**TRIMBLE PATHFINDER PRO XRS ROVER GPS**

- Download Data, if saved
- Verify Transfer of Data
- Back-up Data
- Charge Batteries (batteries are charged overnight)
- Clear Waypoints and Track Logs
- Run Satellite Planning Software nightly (plan next day survey schedule)

**IPAQ 3700 PDA (ARCPAD GIS 6.0)**

- Download Data
- Verify Transfer of Data
- Back-up Data
- Charge Batteries (batteries are charged overnight)
- 

**CELL PHONE**

- Turn cell phone off at end of day
- Charge batteries (batteries are charged overnight)

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**RADIO**

- Turn radio off at end of day
- Charge batteries (batteries are charged overnight)

**DIGITAL CAMERA**

- Download photographs
- Erase Previous Photographs
- Charge Batteries (batteries are charged overnight)

**Ground Reconnaissance Data Collection****Digital Photographs**

Suspected impact location of Practice Bomb

Suspected high explosive crater

OE Related Scrap Material (Outside Known Impact Target Circle)

- Scrap of Nose
- Scrap of Body
- Scrap of Tail Section
- Scrap of Spotting Charge, including integral fuze
- Scrap of Flare
- Scrap of Other Ordnance Items

UXO Item

Excavation of any subsurface anomalies

Start and End Points of Transect (General Terrain Features)

**Track Log and Waypoints**

Establish Waypoints at:

Beginning of Meandering Path

End of Meandering Path

Suspected impact location of Practice Bomb with Photo # &amp; description

Suspected high explosive crater with Photo # &amp; description

OE Related Scrap Material with Photo # &amp; description

UXO Item with Photo # &amp; description

Areas with large number of subsurface anomalies with description

**TRAVEL VOUCHER**

Project: \_\_\_\_\_

Contract Number: \_\_\_\_\_

Name of Traveler				Travel Date:			
Travel From:				Travel To:			
Purpose of Trip:				( Mode of Travel)		(Reason for stop)	
Travel Date:	Time (24 Hour Clock)	Place (Home, Office, City, and State NEAREST AIRPORT(_____))		CA: Commercial Auto CP: Commercial Air PA: Private Auto RV: Rental Vehicle	AD: Auth Delay CM: Change Mode DE: Delay Enroute MC: Mission Complete		
	Dep						
	Arr						
	Dep						
	Arr						
	Dep						
	Arr						
	Dep						
	Arr						
<b>Airline Tickets</b>							
Type of Ticket	From	To	Includes Return Travel	Cost of Tickets			
Prepaid Airline Tickets							
Lowest Price Fare Quoted by USTRAVEL							
Purchased Airline Tickets							
Constructive Airfare Paid		Yes:		No :		\$	
Total Airline Travel Costs						\$	
<b>Ground Transportation</b>							
Mode of Travel	Reason For Travel	Actual Miles	Authorized Miles	Rate Per Mile	Cost of Tickets		
Taxi							
Bus							
POV				\$0.36			
Total Ground Transportation Charges							
<b>Reimbursable Expenses</b>							
Date	Nature of Expense	Amount		Allowed			
Total Reimbursable Expenses						\$	
Employee Name:		Signature			Date:		
Supervisor Name:		Signature			Date:		

Accounting Use Only			
Per Diem Rate	\$	Per Diem	\$
Number of Per Diem Quarters		Air Travel	\$
		Reimbursable Expense	\$
Amount of Per Diem Paid	\$	Ground Transportation	\$
PAID WITH CHECK # _____		Total Travel Cost	\$
		Minus Pre-paid Air Tickets	\$
		Amount Due To Traveler	\$

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## Standard Operating Procedures (SOP)

### Scrap Inspection Operations

#### GENERAL

The following USA policies and procedures are not all inclusive nor are they applicable in all situations. This SOP is not a stand-alone document and is to be used together with project Work Plans (WP), other USA SOPs, the USA Site Specific Safety and Health Plan (SSHP), applicable Federal, State, local regulations, and contract restrictions and guidance. The following USA SOP is for the inspection, storage and certification phases of the Range Residue Handling process, within Range Holding Areas (RHA)

#### REFERENCES

- USAESCH Safety Considerations for UXO;
- USA Safety and Health Program (SHP);
- OSHA, 29 CFR 1910, Occupational Safety and Health Standards;
- OSHA, 29 CFR 1926, Construction Standards;
- Applicable sections of EPA, 40 CFR Parts 260 to 299, Protection of Environment;
- Applicable sections of DOT, 49 CFR Parts 100 to 199, Transportation;
- USACE EM 385-1-1, Safety and Health Requirements Manual;
- CEHNC ER 385-1-92, Safety and Occupational Health Document Requirements for Hazardous Waste Remedial Actions;
- DoD 4145.26-M, Contractors' Safety Manual for Ammunition and Explosives;
- DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards;
- DoD 4160.21-M, Defense Reutilization and Marketing Manual;
- DA PAM 385-64, Ammunition and Explosives Safety Standards;
- AR 385-64, Ammunition and Explosives Safety Standards;
- AR 200-1, Environmental Protection and Enhancement;
- AR 385-10, The Army Safety Program;
- AR 385-16, System Safety Engineering and Management;
- AR 385-40, Accident Reporting and Records;
- TM 9-1300-200, Ammunition General;
- TM 9-1300-214, Military Explosives;
- USA SOPs.

#### 2.0 OBJECTIVE

Processing activities in RHA's involve handling Ammunition, Explosives, and other Dangerous Articles (AEDA). Each processing activity shall be preceded by an inspection to verify that there are no unexploded ordnance (UXO) items or residual explosive hazards present. UXO and residual explosive contamination on or in range residue creates the hazard of personnel injury and/or equipment damage. The extent of UXO or explosive required to create these hazards is dependent on the type of UXO or explosive, its concentration or distribution and confinement. The objective of this SOP is to ensure that all work performed during range residue processing will be accomplished safely and in accordance with applicable Federal, State, local regulations, contract restrictions and guidance.

#### OE SCRAP OPERATIONS

All scrap inspection operations at OE sites will be under the supervision of UXO qualified personnel. Non-UXO trained personnel will not be allowed in the exclusion zone (EZ) unless accompanied by a UXO Technician. The EZ will encompass an area large enough to protect personnel from fragmentation by an unplanned detonation. During operations, USA personnel will strictly adhere to the Site Safety and Health Plan (SSHP) and the following general safety practices:

- Operations will be conducted only during daylight hours;
- Access to operating areas will be limited to only those personnel necessary to accomplish the specific operation;
- UXO will only be handled by qualified UXO Technicians.

During UXO operations the minimum separation distance (MSD) between UXO and non-UXO operations is fragmentation distance of the item (Minimum distances of 1250 (non-fragmenting), 2,500 (fragmenting), 4,000 (bombs and projectiles greater than 5 inches in diameter) feet will be established and maintained around the operating site. Depending on the type of munition being destroyed, the fragmentation distance may be increased or decreased based on the Munition with Greatest Fragmentation Distance (MGFD) obtained using CEHNC's HNC-ED-CS-S-98-2, Method for Calculating Range to No More Than One Hazardous Fragment per 600 Square Feet. Personnel remaining on-site will be limited to those personnel needed to safely and efficiently prepare the item/s for destruction.).

- Non UXO laborers and equipment operators will receive initial ordnance recognition and safety training prior to beginning operations;
- All personnel will attend the daily safety briefing (tailgate safety briefing) prior to entering the operating area;
- Anyone can stop operations for an unsafe act or situation;
- Safety violations and/or unsafe acts will be immediately reported to the Site Safety Officer (SSO);
- Failure to comply with safety rules/procedures may result in termination of employment.

#### **SITE LAYOUT PROCEDURES**

Depending on the SOW operations may or may not include disposal of OE containing explosives. At some sites disposal may be performed by other than USA. This SOP assumes that USA will dispose of any live OE on site. The procedures for establishing the operation are as follows:

- Identify and mark the operating area boundaries.
- The inspection area will be marked with black/yellow survey stakes, caution tape or pin flags.
- Identify disposal area for detonation of OE containing explosives.
- Establish and site an explosive storage area IAW USA's Storage SOP.

#### **INSPECTION PROCEDURES**

Procedures will vary depending on the scope of work (SOW). The SOW may require disposal of items containing explosives. Inspection teams will consist of UXO Technicians or a combination of non-UXO (General Laborers) and UXO personnel. Regardless of the type of operations, UXO operations will only be performed by qualified UXO Technicians. UXO operations are defined as:

- OE identification;
- Handling of UXO, explosives or explosive items;
- Disposal, including movement, transportation, and final disposal of OE.

#### **INSPECTION TEAM STRUCTURE**

The inspection team will consist of either all UXO Technicians or a mix of UXO and Non-UXO personnel. The following is the structure and composition of a typical inspection Team:

- 
- A Senior UXO Supervisor who directs and supervises all team activities, confirms the identification of all OE encountered, maintains the scrap documentation, and certifies the scrap as free from hazardous material.
  - A UXO Technician III who assists the Senior UXO Supervisor, identifies all OE encountered, records the location of the items located, and performs the duties of Site Safety Officer for demolition.
  - UXO Technicians or Laborers who visually search the scrap for OE. These personnel perform their duties under the direction and supervision of the UXO Technician III. Loading and packaging of scrap may be performed by local laborers as long as they are supervised by a UXO Technician and do not handle any OE.

#### TEAM PROCEDURES

Within or adjacent to each operating area, the UXO Technician III will establish a temporary scrap metal and non-hazardous OE collection points. During operations, scrap metal and OE items that are free of explosive contamination (i.e. fragments, parachutes, etc) will be placed into these collection points. The UXO Technician placing the item in the temporary stockpile will perform an inspection to ensure the item is free of explosive hazards. Upon completion of operations, in that area, the UXO Technician III will direct that the materials in these temporary collection points be loaded onto a vehicle for transfer to a central collection point.

As the material is being loaded the UXO Technician III and UXO technicians will perform a second inspection of the material to ensure it is free of explosives and other hazardous materials. At the completion of operations, USA will turn all scrap over to the DRMO or a local scrap dealer for disposal. Prior to releasing the OE-related scrap to the DRMO or scrap dealer, the Senior UXO Supervisor will certify that the scrap contains non-hazardous material. The turn-in document will contain the statement: *"I certify that the property listed hereon has been inspected by me and, to the best of my knowledge and belief, contains no items of a dangerous nature"*, signed by the Senior UXO Supervisor.

Inert Ordnance is treated by explosively opening the munitions case (venting), physically inspecting the filler, and stockpiling the inert scrap/residue. Items to be vented will be transported to the demolition area for treatment. This method ensures that the filler of each piece of "potentially" inert ordnance is physically exposed and inspected and precludes the possibility of transferring an explosively laden piece of ordnance off site.

OE encountered during inspection that is acceptable to move will be transported to the demolition area for disposal. Items that are unfuzed and/or unfired are acceptable to transport unless otherwise instructed. Items that are unacceptable to move will be Blown-in-Place. Operations will be moved to another location until the items are destroyed. Items that may be acceptable to move but not transport may be consolidated to reduce the number of shots required.

#### DISPOSAL OPERATIONS

Disposal operations consist of actions taken at the site to remove the scrap and dispose of the UXO and explosive contamination. Demolition and transportation of OE and explosives will be IAW USA' Demolition and Transportation SOPs. The use of standard Explosive Ordnance Disposal (EOD) procedures for detonating or disposing of OE will constitute the principle control measure for ensuring safety during demolition operations. These procedures, contained in EOD technical manuals, are designed to limit fragments and harmful blast to the immediate vicinity of the disposal operation. These procedures involve the use of controls such as pits, earth cover (tamping), barricades, sandbags, blast mats, etc., and are tailored to the type of munition, its orientation, and net explosive weight (NEW). In addition, the following measures will be taken:

- All UXO will be accounted for and identified by nomenclature, if possible. As a minimum, UXO identification will be by type, by function, and filler;
- Coordination will be made with the FAA to ensure air space clearance prior to the start of operations;
- UXO that is acceptable to move may be consolidated at each site to reduce the number of demolition shots and conserve explosives;
- UXO-related scrap (inert ordnance, expended munitions, mortar fins, etc.) will be removed to the appropriate reutilization office. Should the reutilization office not be established for the receipt of scrap, the contractor will dispose of the scrap through a local scrap dealer at no cost to the

Government. All material will be accounted for through appropriate documentation, as required by the Government and/or scrap dealer;

- Avenues of approach to each disposal site will be controlled to prevent unauthorized access;
- Prior to the start of disposal activities, the Senior UXO Supervisor and Site Safety Officer will verify that the area around the operating site is clear of all nonessential personnel and that other UXO Technicians III have been notified. Prior to priming of demolition charges, all avenues of ingress will be physically blocked by UXO personnel. Radio communications will be maintained among all concerned parties. Avenues of ingress will not be opened without the express permission of the Senior UXO Supervisor. A constant state of vigilance will be maintained by all personnel to detect any intrusion into the fragmentation zone;
- Minimum distances of 1250 (non-fragmenting), 2,500 (fragmenting), 4,000 (bombs and projectiles greater than 5 inches in diameter) feet will be established and maintained around the operating site. Depending on the type of munition being destroyed, the fragmentation distance may be increased or decreased based the fragmentation distance of the item. Personnel remaining on-site will be limited to those personnel needed to safely and efficiently prepare the item/s for destruction.

### **SUMMARY**

The procedures contained in this SOP ensure that scrap materials are properly inspected and certified as containing no hazardous materials. These procedures will be strictly followed and violations of these policies may result in an employee's immediate dismissal.

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**Standard Operating Procedures  
Backhoe Operations****BACKGROUND**

Backhoes may be used to excavate during investigation of subsurface magnetic anomalies, during clearing of rodent nests and for minor road repair to facilitate site access and egress.

**SCOPE**

This standard operating procedure (SOP) contains information specific to backhoe operations. It may also include manuals and publications relevant to backhoes that may be leased, purchased or otherwise employed on the site. It is incumbent upon all designated operators to familiarize themselves with this SOP and to periodically review it an effort to remain current with safe, productive backhoe procedures.

**OPERATIONS**

USA employees who operate backhoes on the project site will be qualified through on-the-job training (OJT); equivalent OJT documented through previous employment or experience or through documented formal training. When engaged in backhoe operations the operator will perform daily inspection and maintenance functions and operate the backhoe as directed. He will also conduct OJT of other operators at the SUXOS or team leader's discretion.

**PERSONNEL PROTECTIVE EQUIPMENT (PPE)**

Level D PPE will be required for personnel engaged in backhoe operations. Clothing items will be:

- Coveralls or work clothing as prescribed;
- Work gloves, leather or canvas, as appropriate;
- Safety glasses - as wind conditions and airborne particulate matter dictates;
- Hardhats;
- Work Boots: Sturdy and of sufficient height to aid in ankle support;
- Hearing Protection: Noise Attenuating Helmet or earplugs will be worn by anyone within 25 feet of the backhoe while it is operating; and
- Dust Masks - as wind conditions and airborne particulate matter dictates.

**GENERAL SAFETY PRECAUTIONS**

The following lateral distances will be maintained when operating a backhoe on a UXO site:

- 200' from other UXO personnel conducting manual, intrusive operations, or
- The approved safe separation distance for the task being performed by other personnel,
- Personnel will know and observe all applicable OE safety precautions, and
- Personnel will know and use appropriate hand signals.

These distances may be reduced or extended by the USACE OE Safety Specialist, based on an assessment of site history, expected UXO, terrain features or other such factors that may apply. The backhoe will not be operated without a spotter. This includes using the front and rear attachments, and backing of the tractor. Prior to starting an excavation, a safety arc will be etched in the ground with the rear boom, fully extended. If operating on a hard surface, the safety arc will be marked with bright spray paint, traffic cones, etc. Prior to anyone entering the safety arc, the operators will:

- Swing the boom arm fully to one side;
- Lower the bucket to the ground;
- Return the engine to idle speed;
- Hold his hands clear of the controls or in the "Hands Up" position.

**EQUIPMENT SAFETY PRECAUTIONS**

See the Operator's Manual.

**TEAM COMPOSITION**

The Team Leader will serve as a safety observer and director for other team personnel and all members of the backhoe team will be UXO qualified. The minimum team make-up will be:

- One operator; and

- One Team Leader/UXO Supervisor.
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**GROUND PERSONNEL**

Team members working on a backhoe team will be qualified through OJT and/or formal training and will perform such tasks as magnetometer checks, manual excavation and checks of the hole as appropriate.

**TRAINING**

Training will be documented in Team Leaders field notebooks and in USA on-site records.

**GENERAL OPERATIONAL PROCEDURES**

The operator will have a radio in place so he can monitor radio transmissions while driving the backhoe to and from excavation sites. Prior to shutting off the tractor engine the operator should let the engine run at idle speed for a few minutes to allow the engine to cool.

Prior to excavation operations the UXO Supervisor shall establish/review hand signals with all members to the team. The backhoe will not be used to excavate closer than 12 inches from UXO. Removed dirt will be placed at least 2 feet from the expected edge of the excavation, and on the uphill side when working on a slope.

Excavations will not be deeper than 4 feet without authorization from the USACE OE Safety Specialist. Such excavations require the UXOSO/Competent person to determine step/slope requirements.

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**USA Environmental, Inc.**  
**Standard Operating Procedures**  
**Disposal/Demolition Operations**

## **GENERAL**

The following USA policies are not all inclusive nor are they applicable in all situations. This Standard Operating Procedure (SOP) is not a stand-alone document and is to be used together with the Work Plan (WP), Site Specific Safety and Health Plan (SSHP), applicable Federal, State, local regulations and, contract restrictions and guidance.

## **REFERENCES**

EP 385-1-95a Basic Safety Concepts and Considerations for Ordnance and Explosives Operations;  
USA Safety and Health Program (SHP);  
OSHA, 29 CFR 1910, Occupational Safety and Health Standards;  
OSHA, 29 CFR 1926, Construction Standards;  
Applicable sections of EPA, 40 CFR Parts 260 to 299, Protection of Environment;  
Applicable sections of DOT, 49 CFR Parts 100 to 199, Transportation;  
USACE EM 385-1-1, Safety and Health Requirements Manual;  
USACE ER 3851-92, Safety and Occupational Health Document Requirements for Hazardous Waste Remedial Actions;  
DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards;  
DoD 4160.21-M, Defense Reutilization and Marketing Manual;  
DA PAM 385-64, Ammunition and Explosives Safety Standards;  
AR 385-64, Ammunition and Explosives Safety Standards;  
AR 200-1, Environmental Protection and Enhancement;  
AR 385-10, The Army Safety Program;  
AR 385-16, System Safety Engineering and Management;  
AR 385-40 w/USACE supplement, Accident Reporting and Records;  
TM 9-1300-200, Ammunition General;  
TM 9-1300-214, Military Explosives;  
TM 60 Series Publications.

## **DISPOSAL/DEMOLITION OPERATIONS**

The following demolition procedures are not all inclusive. Additional safety and procedures information are found in the references cited in paragraph 1.1.

### **GENERAL DISPOSAL OPERATIONS**

The following is a general guide for disposal operations:

Analyze explosive operations with a view towards reducing the number of personnel and quantity of

explosive material subject to an accident. However, never allow one person to work alone;

Prohibit tasks not necessary to the explosive operation in the fragmentation zone of such operations;

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Use sufficient warning signals and maintain a restricted/exclusion area when explosive operations are

conducted. Cease operations when non-UXO personnel are present;

Comply with the authorized explosive limits and safe separation distances;

Discontinue explosive operations when unforeseen hazard conditions develop and do not resume until

the condition is corrected;

Smoke only in designated areas;

Plan for, provide for, and know the emergency procedures in the event of an accident;

Use special care in handling and disposal of damaged or deteriorated explosives, munitions items, and other hazardous materials;

Disperse explosives awaiting destruction, in small quantities at safe distances, and protect them from

unintentional initiation;

Protect explosives and munitions items from the elements and static electricity;

Provide an emergency vehicle outside the fragmentation zone for response in the event of an accident;

Perform disposal operations during daylight hours;

Carry blasting caps in an approved container and handle them carefully;

Do not use UXO for donor charges in demolition operations. They may be in an extremely sensitive and hazardous condition;

Use caution when investigating post demolition shots. Search the area after each shot for any remaining explosives or explosive components.

## **DEMOLITION PROCEDURES**

USA personnel will perform demolition operations in a manner consistent with industry standards and safety practices. The following procedures and safety precautions will be adhered to at all times.

## **OE/UXO BASIC AND GENERAL SAFETY PRECAUTIONS**

These basic safety precautions are the minimum OE safety requirements required of all personnel on site. Other precautions and requirements are in other applicable OE manuals.

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## BASIC CONSIDERATIONS

The following should be taken into consideration when planning or conducting UXO operations:

Safety Is Paramount;

The Preferred Method Of Disposal Is Blow (Detonate) In Place (Bip), However, Items That Are Acceptable to move May Be Consolidated To Reduce The Number Of Shots;

Do Not Move Or Disturb Unidentified Items;

All UXO Will Be Identified, Independently, By Two (2) Uxo Technicians;

Do Not Collect Souvenirs;

Do Not Smoke Except In Designated Areas;

Do Not Carry Fire Or Spark Producing Devices Into The Site;

All Uxo Operations Will Use The "Buddy" System;

Prohibit Unnecessary Personnel From Visiting The Site;

Demolition Operations Will Be law Tm 60a-1-1-31.

## BASIC SAFETY PRECAUTIONS

The following safety precautions are applicable to all UXO:

Suspend all operations immediately upon approach of an electrical storm;

Observe the hazards of electromagnetic radiation (EMR) precautions and grounding procedures when working with, or on, electrically initiated or susceptible OE;

Do not dismantle, strip, or handle any UXO unnecessarily;

Avoid inhalation and skin contact with smoke, fumes, dust, and vapors of detonations and OE residue;

Do not attempt to extinguish burning explosives or any fire which might involve explosive materials;

Do not manipulate external features of ordnance items;

Incorporate appropriate property and personnel protective measures for shock and fragmentation when conducting OE operations;

Do not subject OE to rough handling or transportation. Sand bag, chock, and block appropriately;

Carry explosives in an appropriate container;

Hand carry no more than two items (one in each hand) at a time and then only as required by the operation being performed;

Destroy shaped charge munitions by counter charging the cone to prevent formation of the explosive jet;

The preferred method for disposing of white phosphorous (WP) is to blow the munition in a manner that disperses the WP into the air versus down into the ground;

Do not transport damaged WP munitions unless fully submerged in water;

Avoid unnecessary movement of armed or damaged UXO;

Avoid the forward portions of munitions employing proximity fuzing;

Assume unknown fuzes contain cocked strikers or anti-disturbance features.

## GENERAL SAFETY PRECAUTIONS

The following sub-paragraphs describe safety precautions for various types of munitions/disposal operations:

### Bombs

Ensure fuze wells do not contain fuze components;

Exercise caution when packing fuze wells of bombs or projectiles with explosives as there may be components of the fuze remaining.

### Clusters, Dispensers, Launchers

Approach and work from the sides of a dispenser;

Consider an intact dispenser as fully or partially loaded;

Consider any payloads outside the container or dislodged inside as armed;

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Take precautions for the most hazardous payloads until positively identified.

#### Projectiles

Determine if the projectile has been fired and if so consider it armed;  
Check for the presence of unburned tracers;  
Avoid the rear and front of rocket assisted projectiles;  
Handle projectile components such as powder increments, cartridges, and primers with caution;  
Seal the open ends of projectiles or sheared projectile components with tape or other suitable material before transporting.

#### Grenades

Do not attempt to re-install safety pins on a dud fired grenade;  
Do not attempt to withdraw impinged firing pins from the fuze of a dud fired grenade;  
Do not dispose of grenades by functioning them as designed.

#### Rockets

Approach and work on rockets from the side;  
Do not dismantle or strip dud fired rockets or rocket motors;  
Do not expose electrically fired munitions to radio transmissions within 25 feet;  
Do not transport an unfired rocket motor until having shielded the motor igniter from EMR;  
Dispose of unfired rocket motors, with or without warheads, in such a manner as to prevent them becoming propulsive.

#### Guided missiles

When found, restrict vehicular movement in the area of a guided missile;  
Avoid entanglement with guidance wires of wire guided missiles;  
Restrict radio communications in the vicinity of a dud fired missile;  
Approach and work on missiles from the side and rear quarter;  
Do not dismantle or strip dud fired missiles or missile motors;  
Do not transport an unfired missile motor until having shielded the motor igniter from EMR;  
Dispose of unfired missile motors, with or without warheads, in such a manner as to prevent them becoming propulsive.

## DEMOLITION PROCEDURES

The following sub-paragraphs outline the procedures USA personnel will use to perform both electric and non-electric demolition operations.

### BASIC PROCEDURES:

The method that provides the most positive control over the specific time of detonation is electric.

However, situations may occur, such as an area with a high EMR hazard, when non-electric firing may

be the only option;

Cut fuse long enough when initiating a non-electric charge to reach a safe distance by walking at a normal pace. Use a minimum of six (6) feet of fuse under normal conditions for safe separation time on all shots;

A minimum of 30 seconds separation time will be observed between multiple non-electric shots initiated simultaneously;

A mandatory 60 minute, plus the burn time of the fuse, wait will be observed on non-electric mis-fires;

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For all buried charges use a dual priming system and Detonating Cord, **DO NOT BURY CAPS** ;

The demolition UXO Technician III will investigate mis-fires;

A "fire in the hole" warning will be sounded three times, verbally and on the radio prior to firing a shot.

#### NON-ELECTRIC DEMOLITION PROCEDURES

The following safety and operating procedures will be used to assemble and detonate explosive charges using non-electric firing trains.

#### Safety Considerations

Do all demolition cap preparation procedures a safe distance (minimum 50 feet downwind) from the item(s) to be destroyed and demolition charges. Observe the following safety considerations:

Do not strike, roughly handle, tamper with or attempt to remove or investigate the contents of a blasting cap;

Handle caps only by their open end except during attachment to time fuse or detonating cord;

Maintain positive control of caps;

Do not force time fuse or detonating cord into caps;

Always point explosive end of caps away from body and other personnel during handling and crimping;

Handle primed safety fuse and sensitized detonating cord with care. Avoid contact between caps and/or between caps and other hard objects;

Do not allow time fuse to coil up and contact itself, other time fuse, or explosives.

#### Procedures

Assemble all equipment and explosives. Keep blasting caps away from explosives until priming the shot. Test burn time fuse:

Cut, and dispose of on the shot, the first 6 inches of fuse. This will preclude an inaccurate burn rate or misfire due to moisture.

Cut and test burn an appropriate length of fuse(no less than 3 feet) to determine burn rate.

These procedures will be accomplished at least 50 feet downwind from explosives.

Compute and cut time fuse to length (minimum 5 minutes) required for safe separation time;

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Inspect cap for foreign matter. Do not blow into cap to clear. Holding cap by the open end, lightly tap wrists together. If the foreign matter remains dispose of the cap on the shot and use a new cap;

Crimp cap on time fuse, 1/8 to 1/4 inch from the base of the cap and attach fuse lighter.

Lay out and weight down time fuse;

Prime explosive charge, sound the warning, initiate the fuse, and return to the safe area.

#### Non-Electric Misfire Procedures:

*Note: Wait a minimum of 60-minutes plus burning time of fuse after maximum delay calculated for any part of the disposal shot before proceeding down-range.*

Up range, prepare a new non-electric firing system to include a new donor charge;

After the required wait time has elapsed proceed down range. Place a new charge close enough to the original charge to ensure detonation of both charges. When employing a detonating cord firing system: after the wait time, proceed down range, cut the detonating cord between the cap and the charge, and attach a new firing system to the end of the detonating cord going to the original charge. Destroy the cut detonating cord and cap with the newly primed shot;

Sound the warning, initiate the new firing system and return to the safe area.

#### Electric Demolition Procedures

Personnel performing electrically initiated demolition operations will strictly adhere to the following safety and operating procedures.

#### Safety Considerations

Do all demolition preparation procedures a safe distance ( minimum 50 feet downwind) from the item(s) to be destroyed. Observe the following safety considerations:

Never hook up caps to un-shunted wire;

Never leave caps un-shunted unless actually testing or hooking to firing wire;

Observe explosive safety (i.e., do not strike, handle roughly, tamper with or attempt to investigate the contents of the blasting cap;

#### Procedures

The following procedures will be used to assemble, test, and function electric firing trains:

Prior to going down range, gather all equipment and explosives;

Lay out (from the site to the safe area) and test firing wire;

Ground yourself prior to breaking out caps. Keep explosive end of cap pointed away from

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the body and other personnel;

Grip the cap lead wires 3" to 6" behind the base of the cap, pull an initial arm's length of wire off the wire coil;

Barricade the cap, at least 50 feet downwind from other explosives;

Un-shunt and test blasting cap(s);

Splice the cap leads to the firing wire in a parallel circuit and insulate connections;

Prime the shot;

Return to the safe area and test the circuit for continuity;

Hook up the firing machine, sound the warning, and fire the shot.

#### Electric Misfires:

In order to prevent misfires, insure that:

- All blasting caps are included in firing circuit;
- All connections between blasting cap wires, connecting wires, and firing wires are properly made.
- Short circuits are avoided;
- Grounds are avoided;
- Number of blasting caps in any circuit does not exceed rated capacity of power source on hand.

#### Causes of Electric Misfires

Common specific causes of electric misfires include:

*Note: Wait a minimum of 30 minutes after the last attempt to fire before proceeding down range.*

- Inoperative or weak blasting machine or power source;
- Improperly operated blasting machine or power source;
- Defective and damaged connections, causing either a short circuit, a break in the circuit, or high resistance with resulting low current;
- Faulty blasting caps;
- The use in the same circuit of blasting caps made by different manufacturers or of different design;
- The use of more blasting caps than power source rating permits.

#### 2.4.3.5 Clearing Electric Misfires

*If charge is primed electrically, proceed as follows:*

- Make several successive attempts to fire;
- Check firing wire connections to blasting machine terminals to be sure that contacts are good;
- Make two or three more attempts to fire charge;
- Disconnect blasting machine and short firing wire;

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- A mandatory 30-minute wait will be observed on mis-fires.
  - Test firing circuit with circuit tester for breaks and short circuits, and correct any defects discovered;
  - Remove and disconnect old blasting cap(s) and short wires;
  - Connect wires of new blasting caps(s) to firing circuit and re-prime charge;
  - Reconnect firing wire ends to blasting machine, sound the warning, and fire charge(s).

#### Multiple Sensitive UXO Destruction Trunk and Branch Line Procedure

*Personnel will use the following procedures to explosively link multiple shots, using detonating cord:*

- Lay out detonation (Det) cord trunk line from the initiation point to the farthest UXO, being careful not to contact the UXO with the Det cord, and weighing down (securing) the Det cord as you go;
- Working from the farthest UXO to the initiation point, cut Det cord branch lines of sufficient length, to include additional length for knots and overlap, to reach from the trunk line to the UXO;
- Prepare one end of the branch line, (i.e., sensitize with a knot);
- Attach the bare end of the branch line to the trunk line;
- Utilizing the sensitized end of the branch line, prime a charge and place it as close as possible to, but not touching, the UXO;
- Inspect the trunk and branch lines to make sure none of the primed charges have moved and that no branch line is less than a 90 degree angle with the trunk line from the direction of initiation;
- Proceed to the initiation point, prepare a firing system, either electric or non-electric, sound the warning, and initiate the shot.

### 2.3 SUMMARY

USA uses proven procedures and methods to assemble and function both electric and non-electric explosive demolition shots. Only UXO Trained personnel will perform tasks associated with the assembly and functioning of demolition charges. The procedures outlined in this SOP are based on industry standards and ensure that operations are safely and efficiently performed.

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**STANDARD OPERATING PROCEDURE****VEGETATION REMOVAL****INTRODUCTION AND GENERAL REQUIREMENTS**

All personnel performing operations for Vegetation Removal will conform to this Standard Operating Procedure (SOP). This SOP is not a stand-alone document and all personnel will become familiar with associated documents and/or manuals related to this operation.

**REFERENCES**

- USA Safety and Health Plan. (SHP);
- Site Specific Safety and Health Plan (SSHP);
- Occupational Safety and Health Administration (OSHA) Regulations;
- U.S. Army Corp of Engineers (USACE), EM 385-1-1;
- Operators Manual(s) and Manufactures Publications.

**SELECTION**

Only those means that meet the requirements set forth by Environmental, Customer, and USA Environmental, Inc. will be utilized at the project site to facilitate safe and efficient vegetation removal operations in those areas deemed necessary.

**TRAINING**

All training on equipment will be either formal or on-the-job (OJT) training. This will be documented and subject to review for accuracy and completeness.

**PERSONNEL PROTECTIVE EQUIPMENT (PPE)**

Level D PPE is required for all personnel engaged in Vegetation Removal Operations. Clothing includes but is not limited to:

- Coveralls or work clothing as prescribed;
- Work gloves, leather or canvas as appropriate;
- Safety Glasses;
- Hard Hats;
- Hearing protection, noise attenuators or ear plugs;
- Dust mask, as required by wind conditions and/or the presence of airborne particulate matter;
- Other PPE as needed. (i.e.; face shield, chainsaw chaps, etc.).

**TEAM COMPOSITION:**

The Vegetation Removal Team will consist of three (3) qualified personnel as a minimum. These include:

- UXO Technician III;
- UXO Technician II or I; or
- Laborers.

**UXO TECHNICIAN III**

The UXO Technician III is UXO qualified and directs the operation and other team personnel within the context of removal requirements. The UXO Technician III must be familiar with the equipment being utilized.

**OPERATOR**

The operator(s) will be qualified and trained on the equipment being utilized (i.e. chainsaw, weed eater, etc) and operate the equipment in a safe and efficient manner. The operator performs daily inspections and maintenance functions as required by the operator's manual. The operator will perform other duties as needed or directed.

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**SAFETY**

Safety is paramount, all personnel will observe those safety precautions/warnings that apply or may apply to vegetation removal operations. Those listed below are general in nature and personnel will need to review applicable publications for more specific safety precautions/warnings. Distances are the minimum required.

- Maintain 200 feet minimum from other teams;
- Maintain safe separation distance from UXO personnel engaged in intrusive work;
- Distances may be increased by the COE Safety Specialist as determined by site history, UXO items encountered, terrain features and other factors that may apply;
- Use equipment safety features;
- Safety precautions/warnings found in the operators manual/manufactures publications will be observed;
- Maintain 6 inches of ground clearance during removal operations;
- Communications will be maintained between the Team Leader and Operator(s) at all times;
- Maintain site control;
- Observe UXO safety precautions for items encountered or suspected;
- Ensure PPE is appropriate, serviceable and worn/used in a proper manner.

**OPERATIONAL PROCEDURES**

Personnel will not enter within 10 feet of an operating piece of equipment. If at any time personnel enter closer than 10 feet the Operator will immediately stop, return the engine to idle speed and cease operations. A communications check with the all team personnel, prior to operations commencing, will be conducted. Hand signals will be devised and used as a means of communication. All team personnel must know these hand signals prior to operations commencing. This will be documented on the tailgate safety briefing sheet each morning of operation and at each change of team personnel.

The UXO Technician III will direct the direction and manner in which the vegetation is to be removed. Prior to removal operations commencing a visual search/survey is conducted to determine the hazards that may be encountered including UXO, terrain slope, vegetation, wildlife, environmental concerns and PPE requirements. The UXO Technician III will perform a visual search for UXO, ordnance scrap, surface debris and any other obstruction/object that may pose a hazard to team personnel. Hazardous items, impassable terrain or vegetation that may effect operations will be marked and team personnel notified.

Team personnel are to ensure that a 6 inch ground clearance is maintained during removal operations. Those areas marked as hazards are to be avoided. The manner in which operations are accomplished will follow safe work practices and procedures. Areas of concern will be addressed to SUXOS and/or UXOSO as needed. OE/UXO items encountered are marked and avoided. Notification of these items will be made to the appropriate personnel.

**SUMMARY**

USA personnel to insure that the requirements for Vegetation Removal Operations are conducted in a safe, efficient and productive manner will use this SOP and its references, to include changes and revisions.

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**Standard Operating Procedure**  
**Leased or Rental Vehicles****GENERAL**

The following USA policies and/or procedures are to be used by personnel utilizing leased or rental vehicles for project purposes. Personnel are reminded to obey and observe all applicable Federal, State, and Local traffic laws, regulations or guidance, as well as contractual restrictions and requirements posed by the leasing or rental company.

**REFERENCES**

Information contained in this document was obtained from the below listed references:

- USA Safety and Health Program (SHP);
- Applicable sections of DOT, 49 CFR Parts 100 to 199, Transportation;
- Vehicle owners manual;
- Leasing/Rental agreement;
- Administrative SOP.

**REQUIREMENTS**

Personnel utilizing leased or rental vehicles will comply with the following:

- Only properly licensed personnel will operate vehicles;
- Operators will obey and observe all applicable traffic laws;
- Operators will be familiar with the vehicle in use;
- Operators will observe the cautions and warnings located in the owners manual;
- Operators will be familiar with accident reporting procedures;
- Operators will perform daily inspections of vehicles;
- Operators will report all unsafe or defective conditions found;
- Unsafe conditions will be corrected prior to vehicle use;
- Vehicles are to maintained in a clean and serviceable condition;
- Contractual requirements will be followed.

**PROCEDURES**

The following procedures are to be followed by personnel receiving, using and returning leased or rental vehicles.

- Receiving: Personnel responsible for receiving leased or rental vehicles are to ensure that:
  - Vehicle documentation is accurate and complete, with proper signatures;
  - Operators are properly licensed;
  - Vehicle is clean and in a serviceable condition;
  - Vehicle has all required safety/spare equipment;
  - Owners/operators manual on hand;
  - Copy of lease or rental contract is in vehicle;
  - Perform an inspection of the vehicle prior to acceptance;
  - Use "Lower Option" vehicle if available (ie; vinyl instead of cloth or leather interior);
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- Use: Personnel responsible for the use of leased or rental vehicles are to ensure that:
  - They are properly licensed;
  - They obey and observe all applicable traffic laws;
  - They observe safe operating procedures;
  - They do not allow unauthorized use of the vehicle;
  - They maintain the vehicle in a clean and serviceable condition;
  - They report all unsafe or defective conditions;
  - They do not operate an unsafe vehicle;

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- They report all accidents immediately;
  - They follow all contractual requirements;
  - They perform daily/weekly inspections and document these inspections on the Weekly Vehicle Inspection Sheet;
  - They maintain added safety equipment (ie; fire extinguishers and 1<sup>st</sup> aid kits);
  - Purchase (at company expense) materials to assist in keeping the vehicle clean;
  - Purchase (at company expense) inexpensive floormats and/or seat covers if necessary;
  - Utilize "Wash Racks" (at company expense) if high pressure washing is necessary;
  - Wipe down and sweep out the vehicle interior as needed;
  - Do not use vehicle off road unless necessary;
  - Do not overload the vehicle;
  - Utilize/maintain the vehicle in a manner that reflects favorably upon the personnel and the project.
- Turn-In: Personnel responsible for the turn-in of leased or rental vehicles are to ensure that:
    - The vehicle is **cleaned**, inside and out, prior to turn-in (should be in "as good or better" than when received condition);
    - The vehicle is inspected and results are recorded;
    - All documentation is accurate and complete, with proper signatures;
    - Any discrepancies are corrected or reported prior to departure;
    - All contractual requirements have been met;
    - Copies of all documentation are received;
    - Copies of all documentation are forwarded to Tampa;
    - Damage requiring claims forms have been initiated and Tampa notified;
    - Points of Contact for all parties involved in a claim are listed.

### SUMMARY

The procedures contained within this SOP are not all inclusive. Personnel are reminded to comply with referenced material. To eliminate, reduce and/or mitigate the risks to the vehicle operator, vehicle passengers and the surrounding populace, good, safe driving skills and habits are essential to an accident free project.

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**STANDARD OPERATING PROCEDURES****Supervisors Daily Logs****GENERAL**

The following USA policies and/or procedures are to be used in completing the Supervisors Daily Log. This SOP addresses the reason for keeping a Daily Log, states the requirements for the log book, procedures for making entries, list the required daily entries and provides examples of typical entries.

**REQUIREMENT**

A Supervisors Log is a requirement set forth in UXO Work Plans for UXO clearance actions, EE/CA activities, and UXO support during HTRW and construction activities. A daily Log is required to be maintained by each Team Leader and it must be turned in at the end of the contract. Information from the log, which is used to compile the SUXOS Daily Reports, documents routine actions and records any unusual actions or conditions. The Daily Log becomes a legal document that may be used in legal actions. Logbooks will be supplied to Team Leader; they will have bound pages, which will be consecutively numbered. Pages will not be removed from the book.

**PROCEDURES**

The following procedures will be used for maintaining a Daily Log:

- All log entries will be in ink;
- All entries will be legible;
- The front cover of the logbook will be marked with
  - Team Name/Number
  - Team Leader Name
  - Date Started
  - Date Completed
- Entries will only be made on one side of each page, this will allow for legible photo copies;
- Upon issue, each page will be numbered, the number placed in the top outside corner of the page;
- The time of the entry will be noted in the left column, times will be expressed using the 24 hour clock (i.e. 0930, 1430, etc.);
- Mistakes will be corrected by drawing a single line through the entry, so that it remains legible;
- A copy of each days log will be given to the SUXOS at the end of each day.

**ENTRIES**

The list below presents the required daily entries in the log. The Team Leader should also, at their discretion, make entries noting anything out of the ordinary that may happen during the day. They should include any action or condition that does or may effect the operation of the team and its ability to perform as directed.

**REQUIRED ENTRIES**

The first page/s of the Daily Log will contain the following:

- Site Name;
- Contract Number
- Delivery Order Number
- Task Order Number
- Team Name/Number;
- Team Leader Name;
- Date log started;
- Date log completed/stopped;
- Labor categories and names of all team members;
- Type and serial numbers of all magnetometers.

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Daily entries, which will be dated and signed at the end of each day's entries, will include the following minimum information:

- Name of any normally assigned team member not present and whether the absence is authorized;
- Names of temporarily assigned team members;
- Time and description of each normally scheduled activity, including;
  - Safety meeting
  - Results of daily magnetometer QC check
  - Departure from base area
  - Arrival at work site
  - Completion of Tailgate Safety Briefing
  - Morning and afternoon breaks
  - Lunch breaks
  - Departure from work site
  - Arrival at base area
  - Securing for day

#### ADDITIONAL ENTRIES

Additional entries may include;

- All safety violations, major and minor, including a description of the violation, personnel involved, action taken and final disposition;
- Names of any visitors to the work site and their reason for being there;
- Any unusual occurrences or conditions encountered that may effect the teams production;
- Any additional direction/instructions received from the prime contractor or government personnel (i.e. Corps Safety Rep.);
- All UXO located, the action taken and final disposition (UXO will also be listed on the Grid Sheet);
- Brief description of any demolition operation including the reason for demo; items disposed of; location of operation; results (a detailed description of the operation will given on the Explosives Usage Report);
- Any OE items located that are out of the norm for the site;
- Location of any endangered flora or fauna or historical/archeological significant items encountered, along with a brief description;
- Personnel sickness or injury including; name if individual/s; brief description of sickness or injury; action taken and final disposition (a detailed description of the incident will be made on the Employee Injury Report);
- Personnel concerns or problems including; name of individual/s; description of problem (personal problems should not be included); action taken and final resolution;
- Record of any personnel counseling, either informal or formal, include reason for counseling (i.e. poor work habits, continued safety concerns, problems with other team members, etc.), if formal counseling is required a counseling form will be submitted;
- Accidents, equipment damage or malfunction including; description of equipment (include serial numbers if applicable); brief description of damage or problem; actions taken and final disposition (a detailed description will be provided on the Damaged Equipment Report).

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**STANDARD OPERATING PROCEDURES**  
**SHOCK TUBE FIRING SYSTEM (NON-EL)****NON-EL DEMOLITION**

This Standard Operating Procedure (SOP) is for use by USA Environmental, Inc. personnel who are trained and assigned the task of using Shock Tube Firing System (Non-EL) in the performance of their duties. This SOP makes provisions for the use, storage, and inspection of this equipment. It is the responsibility of the assigned personnel using this equipment to know and follow all applicable requirements, guidance, and directives associated with this equipment and its intended use. This SOP is not a stand-alone document and is to be used with other applicable reference material.

- After cutting a piece of shock tube, either immediately tie a tight overhand knot in one or both cut ends or splice one exposed end and tie of the other.
- Always use a sharp knife or razor blade to cut shock tube so as to prevent the tube from being pinched or otherwise obstructed.
- Always cut shock tube square across and make sure the cut is clean.
- Use only the splicing tubes provided by the manufacturer to make splices.
- Every splice in the shock tube reduces the reliability of the priming system; therefore keep the number of splices to a minimum.

Always dispose of all short cut off piece's IAW local laws as they relate to flammable material.

The shock tube system is a thin plastic tube of extruded polymer with a layer of PETN coated on its interior surface. The PETN propagates a shock wave, which is normally contained within the plastic tubing. The shock tube offers the controlled instantaneous action of electric initiation without the risk of premature initiation of the detonator by radio transmissions, high-tension power lines or by static electricity discharge. The NON-EL system uses detonators in the bunch blocks and in the detonator assembly, which are to be, handled IAW approved procedures.

The high reliability of the shock tube initiating system is due to the fact that all of the components are sealed and unlike standard non-electric priming components, cannot be easily degraded by moisture. Cutting the shock tube makes the open end vulnerable to moisture and foreign contamination, therefore care must be taken to prevent moisture and foreign matter from getting in the shock tubes exposed ends.

**WARNING**

Although the detonation along the shock tube is normally contained within the plastic tubing, burns may occur if the shock tube is held.

**SHOCK TUBE DEMOLITION PROCEDURES****SHOCK TUBE ASSEMBLY**

- Step 1. Spool out the desired length of shock tube from firing point to demolition site and cut it off with a sharp knife or razor blade. Weight down the lose end of trunk line.
- Step 2. Immediately seal off the shock tube remaining on the spool by tying a tight overhand knot in the cut off end.
- Step 3. Using a sharp knife or razor cut the sealed end off of the detonator assembly.
- Step 4. Loosely tie the two shock tube ends to be sliced together in a 3" to 6" loose overhand knot.
- Step 5. Push one of the shock tube ends to be spliced firmly into one of the pre-cut splicing tubes provided by the manufacturer at least ¼ inch. Push the other shock tube end firmly into the other end

of the splicing tube at least ¼ inch. Secure splice with tape if needed.

Step 6. Weight down both sides of the knot area to prevent separation of splice from whip during the firing process.

#### FIRING ASSEMBLY SET UP

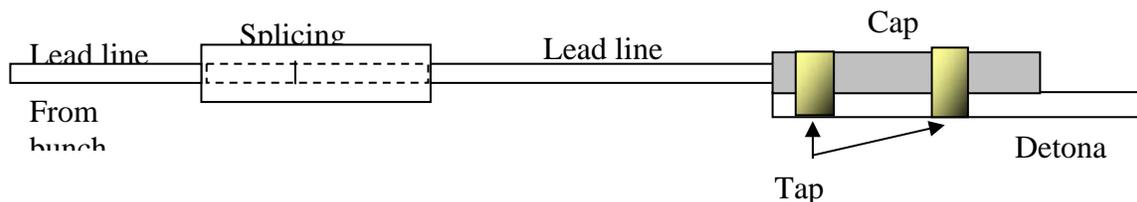
Step 1. If there are multiple items to be destroyed using bunch block(s), supplied by the manufacturer, lay out lead lines at demo site to the shot(s) and secure the bunch block with a sandbag, or some other item which will keep it from moving. Figure 1 illustrates the procedure.

Note: No more than six leads may be used from any one bunch block.

Step 2. If the detonator assembly has not been attached yet then using the splicing tube, splice the detonator assembly to the shock tube lead line as explained in the splicing instructions above.

Step 3. If this is a non-tamped shot place the detonator assembly into the demolition material. If the shot is to be tamped then prepare the demolition material with a detonating cord lead long enough to stick out of the tamping at least one foot.

Step 4. Tape the detonator assembly to the detonating cord lead as shown in Figure 2.



**Figure 1**

Step 5. Conduct a head count, return to the firing position.

Step 6: Cut off the sealed end of shock tube, proceed to the directions listed in Step 7. If you are using a previously cut piece of shock tube, using a sharp knife or razor blade cut approximately 18 inches from the previously cut end, whether or not it was knotted IAW the above guidance.

Step 7. Insert a primer into the firing device and connect the shock tube lead line to the firing device ensuring that the shock tube is properly seated in the firing device.

Step 8. Take cover.

Step 9. Conduct head count.

Step 10. Yell "**Fire in the hole**" three times and initiate charge.

Step 11. Observe a 5-minute wait time after the detonation.

Step 12. Remain in designated safe area until Demolition Supervisor announces "**All Clear**".

#### MISFIRE PROCEDURES.

The most common cause of misfires is known as "black tube failure". The shock tube propagates up to the detonator but the detonator fails to function. The following steps will be taken in the event of a misfire.

Step 1. If the shock tube fails to propagate remove the shock tube from the firing device, cut off six inches of the shock tube, insert a new primer, re-insert the shock tube ensuring that it is properly seated and re-fire. If when you activate the firing device and the shock tube gets blown out of the firing device without activating, cut off six inches of the shock tube, replace the primer and re-insert the shock tube into the firing device.

Step 2. If the primer functioned properly and the shock tube was heard/seen to fire, observe the standard one-hour waiting period prior to going downrange.

Step 3. After the one-hour waiting period has passed, proceed downrange and check the first component in the priming train i.e. splice, bunch block or detonator assembly. Repeat this process till you reach

the detonator assembly. As you conduct this inspection and discover the problem, replace the firing train, which functioned with a new one and ensure that all the connections are correct and secure.

Step 4. After the system has been checked and repaired/replaced return to the firing point and repeat the firing process.

#### **SUMMARY**

This SOP will be followed by those personnel whose duties include the use of the Non-EL system. This SOP establishes guidance and procedures to minimize the potential hazards associated with the demolition activities. Personnel will adhere to the use of Safe Work Practices and Procedures during operations.

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**Standard Operating Procedures**  
**Miniature Open Front Barricade****INTRODUCTION**

This Standard Operating Procedure (SOP) is for use by USA Environmental, Inc. personnel who are trained and assigned the task of using the Miniature Open Front Barricade (MOFB) in the performance of their duties. This SOP makes provisions for the use, storage, and inspection of this equipment. It is the responsibility of the assigned personnel using this equipment to know and follow all applicable requirements, guidance, and directives associated with this equipment and its intended use. This SOP is not a stand-alone document and is to be used with other applicable reference material.

**REFERENCES**

This SOP was prepared using the following reference material:

- HNC-ED-CS-99-1, Open Front and Enclosed Barricades, March 1999 (Terminology Update March 2000);
- CEHNC-OE-CX Interim Guidance Document 00-01 Determination of Appropriate Safety Distances on OE Sites;
- EP 385-1-95a Basic Safety Concepts and Considerations for Ordnance and Explosives Operations;
- Technical Manual 60A-1-1-31;
- Technical Manual 60A-1-1-22.

**WARNINGS AND PRECAUTIONS**

All personnel to ensure safe and proper use of this equipment will adhere to the following warnings and precautions:

- Only trained and authorized personnel will utilize this equipment;
- Safe separation distances will be observed at all times;
- Site control measures will be instituted and maintained at all times during operations;
- Operations will cease upon entry by any unauthorized personnel;
- Violations will be reported immediately for correction;
- All appropriate ordnance and explosive safety precautions will be observed at all times;
- Plates will be installed one at a time during setup operations;
- Plates will be placed into the MOFB, never dropped in place;
- Extreme caution will be used when installing plates, as severe injury to fingers could result;
- The MOFB will NOT be used within 200 feet of non-essential personnel or occupied structures;
- Only one person will occupy the MOFB during excavations and/or investigations;
- Exercise care when entering and exiting the MOFB;
- The MOFB will not be used for munitions with a TNT-equivalent, NEW exceeding 2.3 pounds.

**PERSONNEL PROTECTIVE EQUIPMENT (PPE)**

Personnel while using the MOFB will wear level "D" PPE. PPE will be IAW the SSHP and additional requirements may be directed by appropriate authority.

**INSPECTION**

The MOFB will be inspected for completeness and serviceability prior to and following each use. Missing or unserviceable components will be reported to the Sr. UXO Supervisor or the UXO Safety Officer for repair or replacement.

**STORAGE**

The MOFB will be stored as a complete unit with all plates available to facilitate ease of inspection and accountability of components. MOFB should be placed on a wooden pallet or other suitable material. The MOFB should be transported by the most appropriate method available.

**OPERATIONS**

USA Environmental, Inc. personnel who employ the MOFB will be trained in its proper use. The MOFB will be used to investigate suspected ordnance items in areas where the observation of the Established Exclusion Zone is not possible.

- Install all plates prior to investigating and/or excavating the anomaly;
- The MOFB will be placed with the anomaly located a minimum of 6 inches inside the open front;
- The rear of the MOFB will face the area to be protected;
- Use of the MOFB is based on the MGF, the largest being the 81 mm Mortar, BE, M374;
- Follow all precautions associated with ordnance and explosives;
- Observe safe work practices and procedures.

*"CEASE ALL OPERATIONS IN THE EVENT OF ENTRY BY UNAUTHORIZED PERSONNEL INSIDE THE EXCLUSION ZONE. DO NOT RESUME OPERATIONS UNTIL SITUATION HAS BEEN CORRECTED."*

**SUMMARY**

This SOP will be followed by those personnel whose duties include the use of the MOFB. This SOP establishes guidance and procedures to minimize the potential hazards associated with the investigation and/or excavations of suspected ordnance items. Personnel will adhere to the use of Safe Work Practices and Procedures during operations.

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**USA Environmental, Inc.**  
**Standard Operating Procedures**  
**Explosives Storage and Accountability**

## **GENERAL**

The following USA policies are not all inclusive nor are they applicable in all situations. This SOP is not a stand-alone document and is to be used together with the Work Plan (WP), Site Safety and Health Plan (SSHHP), applicable Federal, State, local regulations and, contract restrictions and guidance.

## **REFERENCES**

Procedures and information contained in this document were obtained from the below listed references:

EP 385-1-95a Basic Safety Concepts and Considerations for Ordnance and Explosives Operations;;;

USA Safety and Health Program (SHP);

OSHA, 29 CFR 1910, Occupational Safety and Health Standards;

OSHA, 29 CFR 1926, Construction Standards;

Applicable sections of EPA, 40 CFR Parts 260 to 299, Protection of Environment;

Applicable sections of DOT, 49 CFR Parts 100 to 199, Transportation;

ATF P 5400.7, ATF-Explosives Law and Regulations;

USACE EM 385-1-1, Safety and Health Requirements Manual;

USACE ER 385-1-92, Safety and Occupational Health Document Requirements for Hazardous Waste Remedial Actions;

DoD 4145.26-M, Contractors' Safety Manual for Ammunition and Explosives;

DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards;

DoD 4160.21-M, Defense Reutilization and Marketing Manual;

DA PAM 385-64, Ammunition and Explosives Safety Standards;

AR 385-64, Ammunition and Explosives Safety Standards;

AR 200-1, Environmental Protection and Enhancement;

AR 385-10, The Army Safety Program;

AR 385-16, System Safety Engineering and Management;

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AR 385-40 w/USACE supplement, Accident Reporting and Records;

TM 9-1300-200, Ammunition General;

·TM 9-1300-214, Military Explosives;

·TM 60 Series Publications.

## STORAGE AND ACCOUNTABILITY

Demolition operations require the availability and storage of explosive materials. To the maximum extent possible, local government facilities will be used.

### STORAGE

USA will comply with local storage criteria and procedures when using Government facilities. When required to provide explosive storage USA will:

Use portable approved Bureau of Alcohol, Tobacco, and Firearms (ATF) Type 2 structures or existing government furnished magazines;

Locate, install, and maintain the magazines to comply with the magazine criteria and quantity distance requirements established in DoD 6055.9-STD, DoD Ammunition and Explosives Safety Standards;

Install sufficient magazines to comply with explosive compatibility requirements, (i.e., bulk explosives, initiating explosives, and OE);

Establish security, such as fencing and/or guards, to prevent unauthorized access and/or theft.

### TYPE 2 OUTDOOR MAGAZINES

A type 2 magazine is a box, trailer, semi-trailer, or other mobile facility.

#### General

Outdoor magazines will be bullet-resistant, fire-resistant, weather-resistant, theft-resistant, and ventilated. They will be supported to prevent direct contact with the ground and, if less than one cubic yard in size, will be securely fastened to a fixed object. The ground around outdoor magazines must slope away for drainage or other adequate drainage provided. When unattended, vehicular magazines must have wheels removed or otherwise effectively immobilized by kingpin locking devices or other methods.

#### Exterior Construction

The exterior and doors are to be of not less than 1/4 inch steel and lined with at least two inches of hardwood. Magazines with top openings will have lids with water-resistant seals or which overlap the sides by at least one inch when in a closed position.

#### Hinges and Hasps

Hinges and hasps will be attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps will be installed so they cannot be removed when the doors are closed and locked.

## Locks

Each door will be equipped with two padlocks fastened in separate hasps and staples. Padlocks must have at least five tumblers and a case-hardened shackle of at least 3/8 inch diameter. Padlocks will be protected with not less than 1/4 inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples.

## ACCOUNTABILITY

USA will employ the following procedures to account for explosive materials:

- Control of and access to explosive magazines will be strictly controlled by the project manager. All issues and turn-ins of explosives will be properly documented and verified, though physical count, by a UXO Quality Control Specialist (UXOQCS);
- On receipt, the type, quantity, and lot number of each explosive item is recorded in the magazine data
- card and the original receipt documents will be maintained on file by the Site Manager;
- All requests for explosives, from the individual operating sites, will be reviewed by the Senior UXO Supervisor. Only sufficient explosives for the day's operations are issued;
- Issues of explosives are recorded on explosive usage records (Figure 2) and deducted from the magazine data card(s) (Figure 1). This procedure will ensure that the quantities of explosives on-the-floor in the magazine reflect the quantities listed on the magazine data card, and that issued explosives are accounted for while they are in the possession of individual users;
- Entries made on the explosive usage records and magazine data cards will be verified through physical count by the UXO Team Leader drawing or turning-in the explosives and the UXOQCS.
- All unused explosives are turned-in at the end of each day, re-entered on the magazine data card and recorded on the explosive usage record;
- At the end of each day the SUXOS and the UXO Team Leader reconcile the entries on each explosive usage record, and will turn these records over to the project manager;

Weekly, the Site Manager will direct that the UXOQCS perform a 100% inventory of all explosives on hand. These inspections will include a physical count of the explosives and a comparison of this amount with the amount listed on the individual magazine data cards. Discrepancies and the results of these inventories will be recorded and reported to the Site Manager.

## SUMMARY

The procedures contained in this SOP ensure that explosive materials are properly stored, accounted for, and issued. These procedures will be strictly followed and violations of these policies may result in an employee's immediate dismissal.