FINAL
Work Plan
Munitions Response Sites

WAIKANE VALLEY IMPACT AREA
KANEOHE, HAWAII

February 2010

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ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
ARAR	Applicable or Relevant and Appropriate Requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CIP	Community Involvement Plan
CSM	Conceptual Site Model
DERP-FUDS	Defense Environmental Restoration Program for Formerly Used Defense Sites
DQO	Data Quality Objective
EA	Environmental Assessment
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
ESS	Explosives Safety Submission
°F	Degrees Fahrenheit
HA	Hazard Assessment
HDOH	Hawaii Department of Health
HEAT	High Explosive Anti-Tank
MC	Munitions Constituents
MCBH	Marine Corps Base Hawaii
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MRS	Munitions Response Site
NAVFAC PAC	Naval Facilities Engineering Command, Pacific
PAL	Project Action Limit
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCP	Quality Control Plan
RA	Risk Assessment
RAB	Restoration Advisory Board
RI/FS	Remedial Investigation/Feasibility Study
SAP	Sampling and Analysis Plan
SI	Site Inspection
SOP	Standard Operating Procedure
TP	Technical Paper
UFP	Uniform Federal Protocol
USACE	U.S. Army Corps of Engineers
USAE	USA Environmental, Incorporated
USEPA	U.S. Environmental Protection Agency
USMC	U.S. Marine Corps
UXO	Unexploded Ordnance

WP	Work Plan
WVIA	Waikane Valley Impact Area

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1.0 INTRODUCTION

USA Environmental, Incorporated (USAE) has prepared this work plan (WP) in accordance with the Performance Work Statement dated 29 January 2009. This WP describes field activities planned for a Remedial Investigation (RI) at the Munitions Response Site (MRS) located at Waikane Valley Impact Area (WVIA), Kaneohe, on the island of Oahu, Hawaii (see Figure A-1). The RI consists of a surface clearance and subsurface investigation to determine the extent of hazard associated with munitions and explosives of concern (MEC) and Munitions Constituents (MC). The findings of this clearance and investigation will augment the data collected in previous investigations and will provide a basis for conducting a MEC hazard assessment and completing a Remedial Investigation/ Feasibility Study (RI/FS) Report.

The information collected during this RI will aid in the selection of areas to be further evaluated, remediated, or approved for no further action by the WVIA Project Team (Project Team) if it is agreed these areas do not pose an unacceptable level of risk to human health and the environment. The Project Team working on the RI effort currently comprises individuals from the Navy, the U.S. Environmental Protection Agency (USEPA) Region 9, and Hawaii Department of Health (HDOH). The Project Team participants vary depending on the nature of the issues at hand, and other stakeholders may be (or may have been in the past) active in the team process or meetings.

1.1 REGULATORY DRIVERS

The principal regulatory driver for the RI activities is the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Pursuant to CERCLA, the National Contingency Plan (NCP), Executive Order 12580, existing cleanup authorities and programs will be followed during the risk and hazard reduction actions. Additionally, the U.S. Navy (Navy) must meet the provisions of Department of Defense Explosives Safety Board guidance, found in the Department of Defense Ammunition and Explosives Safety Standards (6055.9-STD) governing the remediation of real property contaminated with ammunition, explosives, or chemical agents prior to land transfer. Under CERCLA 120 and Executive Order 12580, the Navy is the lead agency responsible for the cleanup effort. USEPA Region 9 and HDOH provide oversight, with HDOH being the lead regulatory agency.

The NCP requires that substantive requirements of applicable or relevant and appropriate requirements (ARARs) be followed. However, CERCLA response actions are exempt from Federal, state, or local permitting requirements related to any activities conducted completely on site. In addition, under the requirements of CERCLA, the Navy must perform all remedial actions necessary to protect human health and the environment. The EPP addresses project ARARs and describes the measures that will be used to protect the environment and comply with project ARARs in this regard.

1.2 ORGANIZATION OF THE DOCUMENT

This RI Work Plan has been divided into several sections (Sections 1 through 11) with associated documents provided either as appendices herein or as standalone documents. Together, the WP and associated documents present the project history, work elements, and requirements in an organized manner. Each of the associated documents and the Explosives Safety Submission (ESS) will be fully implemented during the RI to ensure safe, compliant, and effective completion of the planned studies. All figures referenced in the body of the Work Plan are located in Appendix A, Site Maps and Drawings.

Table 1-1 describes the general structure and organization of this RI WP. References are frequently made between various sections in the WP and the associated documents.

Table 1-1: RI Work Plan Structure

Section Number	Descriptor	Information
1.3	Site History and Background	A summary of prior military and cultural use of WVIA, and of previous studies conducted at the site.
1.4	Physical Characteristics	Information on geology, hydrology, natural resources, vegetation, wildlife, weather, and climate
1.5	Conceptual Site Models (CSM)	A description of the AOCs, CSM describing exposure pathways, and CSM of proposes land use.
1.5	Community Relations	Information on the Restoration Advisory Board (RAB), public involvement, and stakeholder issues and concerns
2	DQO	Project data quality objectives (DQOs) for MEC and MC chemical sampling with reference to the MEC and MC SAPs
3	RI Methodologies	A description of the various RI methodologies that will be followed.
4	Hazard Assessment	The Hazard Assessment Methodology and description of the MEC HA methodology that may be conducted for the WVIA AOCs
5	RI Report	A description of the RI Report to be prepared following field work
6	Project Management	A description of project management coordination requirements including a project schedule
7	References	Citation of documents referenced within this Work Plan

The following appendices are associated with this WP:

- Maps - All figures showing AOC locations, site features, location of past survey tracts, prior MC sample locations, as well as proposed survey tracts and proposed MC sample locations
- MEC Sampling and Analysis Plan (SAP) – A document based on the Uniform Federal Protocol Quality Assurance Project Plan (UFP QAPP) guidelines presented as a series of worksheets containing MEC-related activities and data quality objectives (DQOs) for MEC-related quality assurance requirements. Also includes standard operating procedures (SOPs) related to MEC work.
- MC SAP – The MC Sampling and Analysis Plan prepared in accordance with the UFP QAPP requirements. It includes field sampling SOPs.
- QCP – Quality Control Plan detailing the general QC processes that will be followed during all aspects of the project.
- APP – Accident Prevention Plan including general and site-specific information related to safety and health concerns during the RI.
- EPP – Environmental Protection Plan identifying ARARs and describing mitigation strategies and management practices for actions affecting the environment.
- AMP – Archaeological Monitoring Plan describing the archaeological history of the site and the monitoring and mitigation procedures for protection of archaeological resources.

The ESS is also being prepared as a separate document and is not attached to the RI WP. This document must be approved by the Marine Corps Systems Command prior to beginning fieldwork.

1.3 SITE HISTORY AND BACKGROUND

1.3.1 SITE HISTORY

The MRS consists of 187 acres located in the Waiahole and Waikane Valley, on Oahu's windward side approximately 10 miles northwest of Kaneohe Bay. It was once part of a 2,000-acre lease used for jungle training and field maneuvers. The remaining acreage falls under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS) and is not addressed under this RI.

WVIA's military history dates back to the early 1940's when the Army leased over 2,000 acres in the Waiahole and Waikane Valleys for jungle training, field maneuvers and a bombing range for air-to-ground ordnance delivery practice. The area was known as the Waiahole Training Area and managed by the U.S. Army as property of Fort Hase.

Between 1943 and 1953, the Army leased this property for maneuvers, jungle training, and small arms, artillery, and mortar firing. The U.S. Marine Corps (USMC) leased 1,061 acres of the training area in 1953. Training consisted of small arms fire, 3.5-inch rockets, and possibly medium artillery fire. Live fire apparently stopped in the early 1960's. Due to fire hazards, incendiaries were prohibited and all ammunition in excess of .50 caliber was to be fired into the designated impact area. The lease was terminated in 1976 and returned to the original owners who farmed and developed it.

In 1944, four people were injured, two fatally, when a 60mm mortar discovered in Waikane Valley accidentally detonated. Three children were injured in 1963 when a souvenir rifle grenade reportedly discovered in Waikane Valley exploded after it was thrown against a wall. There are no other reports of fatalities or injuries attributable to MEC discovered at Waikane Valley.

The USMC conducted ordnance clearance sweeps in 1976 and 1984. The 1976 clearance effort resulted in the removal of over 24,000 pounds of practice ordnance and fragments, including 42 items of unexploded ordnance. The after action report stated that 187 acres of the WVIA can never be certified free of unexploded ordnance due to the ground cover and topography. In December 1983, heavy rain exposed ordnance on the property and Marine EOD removed a number of 3.5-inch rockets. In January 1984, Marines conducted a sweep and removed 480 3.5-inch rockets. In June 1984, an intensive ordnance clearance resulted in the removal of 16,000 pounds of demilitarized practice ordnance and 190 items of unexploded ordnance from the parcel. The after action report supported the conclusions of the 1976 report that the property could never be certified clear of ordnance.

In 1989, the government acquired title to the 187-acre ordnance contaminated area of the original WVIA. Fencing of the property was completed in 1992 and remains as government property due to it being deemed improbable that it can be cleared of all ordnance contamination. The area is currently controlled and maintained by Marine Corps Base Hawaii (MCBH). The project site is managed as an "other than operational range", with access controlled by MCBH such that civilians may only enter the property when accompanied by EOD personnel.

1.3.2 PREVIOUS INVESTIGATIONS

1.3.2.1 Range Investigation and Preliminary Range Assessment/Archives Search Report

The 187-acre MRS was identified for further evaluation as a result of a Range Investigation and Preliminary Range Assessment and Archives Search Report completed in 1998. MCBH contracted with U.S. Army Engineer District, Honolulu to prepare an Environmental Assessment (EA) to evaluate the effects of a Proposed Action of conducting non-live fire jungle orientation and maneuver training within the 187-acre property. The Proposed Action was cancelled in September 2004 after the Marine Corps determined that Waikane Valley is unsuitable for troop training because of safety concerns.

1.3.2.2 Engineering Evaluation/Cost Analysis

From June 2005 until May 2006, U.S. Army Corps of Engineers conducted field work for an Engineering Evaluation/Cost Analysis (EE/CA), evaluating MEC risks over 874 acres of the FUDS portion of WVIA adjoining the southern and western boundaries of the MRS. The EE/CA consisted of evaluation of 150 grids (100 ft by 100 ft) and 9 miles of transect. During the investigation, seven MEC items were recovered; two 81mm HE rounds, three 60mm HE rounds, and two 37mm HE projectiles. All of the MEC items were recovered in the southeastern portion of the FUDS site, which adjoins the southern boundary of the MRS. Projectile fragmentation, fuze pieces, tail fins, base plates, and other munitions debris were located throughout the valley.

1.3.2.3 Site Inspection

Naval Facilities Engineering Command, Pacific (NAVFAC PAC) conducted site inspection activities at WVIA from 29 September to 30 October 2008. An instrument-aided field reconnaissance survey was conducted to evaluate and document the presence of MEC, MC, or other munitions-related finds. The field teams surveyed approximately 10 percent of the accessible areas of the site for a total of 14.75 surveyed acres. Transect surveys covered 9.55 acres and cell surveys covered 5.2 acres. Transects and cells were spread across the site as evenly as possible considering the rough terrain. Cells were located in open areas wherever possible to avoid disturbance of vegetation, and the ideal cell size of 50' by 50 ' was expanded or contracted to fit the available area. The soil sampling team collected 35 composite samples in the lower elevations of the site and 10 discrete samples at locations where MEC items had been found. Samples were analyzed for 9 metals and for nitroaromatics and nitroamines. The analytical results were compared against Project Action Limits (PALs) consisting of USEPA Region 9 industrial preliminary remediation goals, HDOH Tier 1 Environmental Action Levels, and Soil Background Criteria.

Four target areas were identified as Areas of Concern (AOC). Many items of munitions debris (MD) were noted during the site inspection. Seventy MEC items were found, all fired and fuzed and therefore considered unexploded ordnance (UXO). The UXO items included sixty-six 3.5-inch shoulder fired High Explosive Anti-Tank (HEAT) Rockets, one 2.36 inch shoulder fired HEAT Rocket warhead, and three HEAT Rifle Grenades.

The analysis of four soil samples revealed a potential for copper and lead impacts above the PALs. These localized concentrations of copper and lead are believed to be related to high concentrations of munitions debris at the four AOCs.

1.3.3 LAND USE

The EA report indicated that the site has had no modern construction. The property is bounded to the north, south, and west by undeveloped forest lands owned by Kualoa Ranch and SMF Enterprises, Inc. In 1997, the City and County of Honolulu began to acquire lands to the southeast of the project site from Azabu USA Corporation. These lands were then designated as the Waikane Nature Preserve. The Roberts family owns a small parcel adjacent to the southern border of the project site. Non-contiguous coastal lands to the east of the project site include a mix of residential areas, beach parks, and private property. Approximately 51.963 acres (less than 28 percent) of the southern portion of the project site were leased for agricultural purposes prior to land acquisition by the federal government. The State of Hawaii land use classification for this leased area was Agriculture. Roughly 17 acres (33 percent) of this leased area was farmed with edible crops. Five vacant living units existed within the leased area. The remaining 135.393 acres are lands designated by the State of Hawaii Land Use Commission as Conservation and were within the area designated as the Waiahole Forest Reserve.

The Draft Engineering Evaluation/Cost Analysis (EE/CA) Report Plan, Former Waikane Valley Training Area, Island of Oahu, Hawaii indicates that the City and County of Honolulu has produced a Master Plan to develop the FUDS portion of WVIA (874 acres) into the Waikane Valley Nature Park. The plan involves establishment of trails, rest and picnic areas, and lookouts to view surrounding landmarks, a ceremonial gathering place (halau), re-vegetation areas for native plants, stream ecology study areas, ponds for aquatic wildlife studies, agricultural fields, parking areas, and a visitor orientation area. The majority of the acreage within Waikane Valley consists of inaccessible terrain that cannot be developed due to steep gulches, canyons, rocky outcrops, and mountains rising over 2,200 feet above sea level.

However, evidence shows that the whole of Waikane Valley has been used, and in all probability will continue to be used, by sportsmen hunting wild boar and other game.

With the exception of some new homes along Haupoa Road and Kamehameha Highway, very little housing development has taken place in Waikane.

1.4 PHYSICAL CHARACTERISTICS

1.4.1 TOPOGRAPHY AND GEOLOGY

Waikane Valley is located on windward Oahu approximately 10 miles (16 kilometers) northwest of MCBH. It is one of several valleys with watersheds draining into the northern part of Kaneohe Bay. Windward Oahu is the remnant of the Koolau Volcano. Waikane was carved into the basalt of the Koolau Range through erosion. Some of the gravel and clay formed by weathering and erosion of the shield were deposited on valley floors. In addition, alluvium of marine origin accumulated in the valleys as the sea level rose during interglacial periods and fell during glacial periods.

The project site extends along a gradient from 100 feet above mean sea level at the southern boundary to approximately 1,400 feet along the northern boundary. Much of the project area has slopes exceeding 45 percent, with some sections containing steep vertical cliffs (Tuggle and Wilcox 1998).

The Koolau volcanic series is the type of Caprock from which the soil at Waikane Valley was derived. Caprock soil is a broad term for any soil derived from any underlying volcanic Caprock. According to the U.S. Department of Agriculture, Soil Conservation Service (1972), the five soil types within the project site exhibit the following characteristics:

<u>Waikane silty clay, 25 to 40 percent slopes (WpE)</u>. This soil type is found on steep terraces and alluvial fans. WpE soils are very strongly acid in the surface layer and subsoil, with moderately rapid permeability, medium to rapid runoff, and a moderate to severe erosion hazard.

<u>Waikane silty clay, 40 to 70 percent slopes (WpF</u>). On WpF soil, runoff is rapid to very rapid and the erosion hazard is severe.

<u>Waikane silty clay, 40 to 70 percent slopes (WpF2)</u>. This soil type is very similar to WpE except that it is very steep. Most of the surface layer and, in some places, part of the subsoil has eroded. Soft weathered rock is exposed in a few areas. On WpF2 soil, runoff is rapid to very rapid and the erosion hazard is very severe.

<u>Rock land (rRK</u>). This classification refers to areas where exposed rock covers 25 to 90 percent of the surface. The main characteristics of rRK are rock outcrops (of mainly basalt and andesite) and very shallow soils.

<u>Hanalei silty clay, 0 to 2 percent slopes (HnA)</u>. This soil type is found on stream bottoms and flood plains. HnA soils are strongly acid to very strongly acid in the surface layer and neutral in the subsoil, with moderate permeability. On HnA soil, runoff is very slow and the erosion hazard is no more than slight.

Waikane Series soils (WpE, WpF, and WpF2) are found on approximately 75 percent or the majority of the project site (Belt Collins & Associates 1990 and Tuggle and Wilcox 1998). The WpE soils type is primarily found below the 300-foot contour (Belt Collins & Associates 1990). Land at the top of the ridge at the northern boundary of the project comprises rRK whereas HnA is found at the southeastern corner of the site along Waikane Stream (Belt Collins & Associates 1990 and Tuggle and Wilcox 1998).

1.4.2 WATER RESOURCES

Waikane Stream traverses the project site along its southern border at approximately the 150-foot elevation. The U.S. Geological Survey has monitored stream flow at the 75-foot elevation approximately 1,150 feet downstream from the eastern border of the property since 1959. Its records indicate Waikane Stream to be perennial (Belt Collins & Associates 1990).

Since 1916, the Waiahole Ditch Tunnel System has intercepted water at the most productive portion of the Waikane catchment upstream from the site, thereby altering flow volume and other hydrological characteristics of Waikane Stream (Drigot et al 2001).

Water quality sampling of the perennial Waikane Stream was accomplished in May 2003 at four sampling stations from above to below the project area to measure temperature, pH, conductivity, dissolved oxygen, turbidity, total suspended solids, and nutrients (as ammonia, nitrate plus nitrite, total nitrogen, and total phosphorous). Differences between stations were found to be small and values were within ranges indicating good water quality (AECOS Consultants 2003).

1.4.3 GROUNDWATER

The United States Geological Survey Ground Water Atlas of the United States HA 730-N indicates that WVTA site is located in the Koolau Rift Zone groundwater area of Oahu. This area consists mostly of dike-intruded Koolau Basalt, which is the principal aquifer. Regional ground-water movement is from the highlands to adjacent ground-water areas and directly to the ocean. Dike-impounded water is most important in this ground-water area, and some water levels are as much as 1,000 feet above sea level.

According to the HDOH map of Oahu's Underground Injection Control Areas, WVTA lies inland of the Underground Injection Control line, and therefore the underlying aquifer is considered a drinking water source.

The depth to groundwater has not yet been determined at this site. However, because of the steep terrain and underlying rock strata, it is assumed that infiltrated water along the slopes may accumulate in small pockets in the bedrock but generally flows towards Waikane Stream and is transported to the Pacific Ocean approximately one mile downstream from the site.

1.4.4 CLIMATE

The climate of Hawaii is warm and humid year round. The daily average temperature on Oahu ranges between 65 to 85 degrees Fahrenheit (°F) with relative humidity ranging from 30 to 90 percent (Juvik and Juvik 1998). The project site is located in the interior of the forested Waikane Valley. All of these windward valleys, from Kaneohe in the south to Hakipuu in the north, support lush vegetation owing to an abundance of water.

1.4.5 BIOLOGICAL RESOURCES

Literature and field surveys of the project site conducted by biologists and environmental specialists conducted (AECOS Consultants 2003) resulted in the following findings:

1. **Vegetation.** The project site has been highly disturbed in the past such that only remnants of native vegetation remain. Native plant communities such as *'Ohi'a Scrub* and *Koa/'Uluhe Woodland* occur on some of the ridges that extend to the northern ridge line. The *Ohi'a Scrub* community occurs on the ridges at the north side of the project site, and particularly on the eastern end. It is characterized by low and shrubby *'ohi'a* trees with dense clumps of the native fern *pala'a (Sphenomeris chinensis)* between the shrubs. *Koa/'Uluhe Woodland* dominates the northwestern portion of the project site on the ridge leading up the hills that separate Waikane Valley from Kaaawa Valley. This plant community comprises *Dicranopteris linearis ('uluhe)*. Two plant communities (i.e., Managed Land Vegetation and Secondary Forest) found in most of the flat to sloping areas south of the hills on the northern portion of the project site reflect extensive disturbance. Managed Land Vegetation exhibits the characteristics of abandoned agricultural clearings that cover large patches on the alluvial plain of the Waikane Stream, and the areas around the abandoned living sites. Most of the lowlands of the site are covered by Secondary Forest, which is a plant community almost entirely dominated by alien tree species. The most prevalent of these alien tree species is

Paraserianthes falcataria (“albizia”), which is a huge, fast-growing tree with an open, spreading canopy. No distinct wetlands were found within the project site.

A total of 104 vascular plant species were recorded. Of the 104 species, 17 are native but only five of the native species are endemic to Hawaii: *Cibotium chamissoi (haupu’u ‘i’i), Acacia koa (koa), Scaevola gaudichaudiana (naupaka kuahiwi), Metrosideros polymorpha (‘ohi’a lehua)*, and *Wikstroemia oahuensis (‘akia)*.

2. **Fish and Wildlife.** The non-native arthropod, mammalian, and avian species identified at the project site are consistent with the habitat found at the project site. Many common non-native species are present. Medically important species (i.e., centipedes, scorpions, widow spiders, western yellow jacket wasps, and common paper wasps) were not observed but may be present. Four mammalian species – domestic dog *(Canis f. familiaris)*, small Indian mongoose *(Herpestes a. auropunctatus)*, domestic cat *(Felis catus)*, and feral pig *(Sus s. scrofa)* – were observed. Fifteen species of birds from 11 separate families were observed. The findings of the avian survey were consistent with the habitat and altitude of the study area. No native avian species were detected. A few native species of aquatic life were found in the middle and lower reaches of Waikane Stream, but were noted as not especially unusual or unique.
3. **Listed Species.** Surveys of the project site conducted by Char and Associates (1989) and AECOS Consultants (2003) found no federally listed threatened or endangered plant species and no plants proposed for such status. Snail species listed as threatened or endangered under federal or state statutes (i.e., *Achatinella*) were not found (AECOS Consultants 2003). The endemic Hawaiian sub-species of the Short-eared Owl *(Asio flammeus sandwichensis)* was not detected during surveys but may occasionally use resources present within the site, especially in the more open *‘uluhe* dominated higher elevations of the valley wall. The Oahu population of this sub-species is listed as endangered by the State of Hawaii, but it is not listed under federal statues (DLNR 1998 and Federal Register 1999a, 1999b, 1002, 2002). Typical nesting habitat for the threatened Newell’s Shearwater *(Puffinus auricularis newelli)* is found on the upper *‘uluhe* covered slopes. There are no known nesting colonies of this species on Oahu; however, a small number of these birds are downed annually on the island, most near the lighted entrances to the Pali Highway tunnel. (AECOS Consultants 2003).

1.4.6 CULTURAL RESOURCES

The Environmental Assessment notes that field investigations and ethnographic interviews were conducted in 2003, and a *heiau* or shrine within National Register of Historic Places was identified and recorded in February 2004 (Magnuson et al. 2004). The project site was divided into three sampling zones based on terrain variations in Waikane Valley. Zone A, along Waikane Stream where archaeological sites had previously been identified, was subjected to a systematic and intensive survey and re-recordation of previously documented sites. Zone B, a transition area between the flatter areas near Waikane Stream and the extremely steep slopes along the valley walls, was subjected to a reconnaissance level survey. Zone C, comprising extremely steep slopes along the valley walls, was visually inspected from available vantage points in Zone B and from the ridgeline above. Seven sites were evaluated, several of them within a National Historic Register site. Four were reconfirmed as significant, two were recommended for deletion from state inventory, and one was newly identified as historic. All culturally significant sites appear to be located in Zone A, less than 0.2 kilometers from Waikane Stream. Archaeological monitoring will be required during intrusive activities in Zone A.

1.5 CONCEPTUAL SITE MODELS

1.5.1 EXPOSURE CSM

The Exposure CSM (shown graphically in Figure A-4 and in three dimensions in Figure A-5) illustrates the site and its environmental setting and presents information regarding MEC and MC contaminant sources, MEC and MC migration pathways, and receptor exposure pathways potentially present at the MRS. The MEC CSM is discussed in the MEC SAP and the MC CSM is discussed in the MC SAP.

Five AOCs have been identified for further investigation as a result of previous investigations. Four AOCs are target areas as shown in Figure A-2. These four AOCs are being investigated because of the presence of MEC and the potential presence of MC. The area along Waikane Stream is identified as an AOC because it is located down-gradient of the other four AOCs and has a potential for MC migration from the targets. The AOCs and their potential concerns are listed in Table 1-2.

Table 1-2: Areas of Concern

AOC	Acreage	MEC Concerns	MC Concerns
1	1.8	Small arms	Copper, lead
2	7.9	Rockets, rifle grenades	Copper, lead
3	8.4	Rockets, rifle grenades	Copper, lead
4	5.1	Rockets, rifle grenades	Copper, lead
5	NA	Potential migration of MEC by erosion	Copper, lead

AOC 1 is the westernmost target at WVIA and is situated at and above the 400-foot elevation. Although only small arms rounds were found at the target site during the SI, a 3.5-inch rocket was found nearby. AOCs 2 and 3 are located in the center of WVIA and are situated between the 300- and 400-foot elevations. Numerous rifle grenades and 2.36-inch and 3.5-inch High Explosive Anti-Tank (HEAT) rockets, as well as MD associated with these MEC items, were found at AOCs 2 and 3. AOC 4 is the easternmost target and is situated between the 300- and 400-foot elevations. Similar MEC hazards as in AOCs 2 and 3 were found in AOC 4, but in lighter concentrations. The target locations can be roughly located by viewing the steep, severely eroded slopes which are now bare of vegetation. MEC items project from the bare slopes, and it is evident that many items have migrated down-gradient over the years due to erosion at the impact areas.

1.5.2 LAND USE CSM

Figure A-3 is a CSM of proposed future land use. This CSM is discussed in detail in the MEC SAP.

1.6 COMMUNITY RELATIONS

The Project Team is active in fostering good community relations. The team includes representatives from the Navy, USEPA, and HDOH. The Project Team is tasked with developing a plan for investigating sites with potential MEC hazards, while considering the concerns of regulatory agencies, community members, and future users of WVIA. That plan is formally referred to as the “RI Work Plan” for WVIA.

The Project Team met either in person or by teleconference for several scoping meetings to establish data quality objectives for WVIA. The Project Team also met with the RAB and held open houses to invite community input. The Navy has continued to coordinate with stakeholders to address their concerns and involve them in the planning for this WVIA RI Work Plan.

1.6.1 INFORMATION REPOSITORIES

Three Information Repositories have been provided with copies of the draft and draft final SI Reports, and to the draft RI Work Plan, in order to give the public an opportunity to review and comment. One repository is located at University of Hawaii at Manoa, Hamilton Library (Hawaiian & Pacific Collection), 2550 McCarthy Mall, Honolulu, Hawaii 96822. A second repository is located at Kaneohe Public Library, 45-829 Kamehameha Highway, Kaneohe, Hawaii 96744. The third repository is located at KEY Project, 47-200 Waihee Road, Kaneohe, Hawaii 96744.

1.6.2 COMMUNITY INVOLVEMENT PLAN

The MCB Hawaii Community Involvement Plan (CIP) formalizes the process for involving the Waikane community, interested members of the public, and the extended community in environmental restoration and property reuse. The CIP was first prepared in August 2007.

1.6.3 RESTORATION ADVISORY BOARD

A RAB was formed in June 2007 and RAB members signed the RAB charter in April 2008. The RAB charter states: "The mission of the RAB is to establish and maintain open and interactive dialogue between the US Marine Corps, state and federal regulatory agencies, and the local community concerning the Munitions Response Program in Waikane Valley Hawaii." Individuals interested in becoming members of the RAB filled out applications, and all of the applicants were accepted as RAB members. The group consists of private citizens and representatives of various organizations.

Currently, the RAB meets approximately every 6 months, typically at the Waiahole Elementary School near the site. Additional RAB meetings are scheduled as the need arises. The public is invited to all RAB meetings. The RAB will continue to be a vehicle for informing the public about ongoing remediation and future plans. RAB meetings are led by a RAB Community Co-Chair and a Marine Corps Co-Chair who receive RAB input and address issues and concerns during and between RAB meetings.

1.6.4 FACT SHEETS AND NEWSLETTERS

Several fact sheets relating to the cleanup work at WVIA have been distributed since 2007. Fact sheets are made available at RAB meetings and are also posted on the Marine Corps Base Hawaii website at http://www.mcbh.usmc.mil/g4/environ/WaikaneRAB.htm.

1.6.5 PUBLIC COMMENT

RAB members and citizens interested in environmental restoration of WVIA may contact the RAB Community Co-Chair or the Marine Corps Co-Chair. Proposed plans and other documents that require public comment are made available on the Marine Corps Base Hawaii website and in the Information Repositories at the University of Hawaii Hamilton Library, the Kaneohe Public Library and the KEY Project. The RAB Community Co-Chair is notified when draft documents are available for review and the RAB members are also notified.

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2.0 DATA QUALITY OBJECTIVES

DQOs have been developed in accordance with USEPA's *Data Quality Objectives Process for Hazardous Waste Site Investigations*, USEPA QA/G-4HW (EPA 600-R-00-007) (USEPA 2000). Each of the planning steps described in the USEPA document was addressed in the development of the DQOs.

The DQOs reflect the goals for the RI and the general MEC and MC processes developed for WVIA. They are designed to guide the successful collection of sufficient data of high enough quality to support the hazard assessment and FS evaluation that will be needed to complete remediation of the WVIA AOCs.

DQOs for the WVIA RI are presented in the MEC SAP and the MC SAP.

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3.0 REMEDIAL FIELD INVESTIGATION METHODOLOGY

The RI methodology consists of combinations of field activities designed to fill data gaps identified in the MEC SAP and the MC SAP. These field activities include:

- Site preparation including staking of grids and vegetation removal.
- Instrument-aided surface clearance of target AOCs.
- Surface and subsurface MC soil samples within target AOCs.
- Sediment samples within Waikane Stream AOC.
- Subsurface clearance of selected grids within the target AOCs.
- Subsurface clearance of a single transect along southern end of AOCs 2, 3, and 4.
- Geophysical mapping and analysis of subsurface-cleared grids and transect.
- Disposal of Materiel Potentially Presenting an Explosive Hazard and MD.

The approach, methods, and operational procedures USAE will employ to execute the above activities are addressed in the MEC SAP, the MC SAP, and the associated SOPs.

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4.0 HAZARD ASSESSMENT (HA) METHODOLOGY

The baseline risk assessment is an analysis of the potential adverse health effects (current or future) caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these releases. The results of the baseline risk assessment are used to:

- Evaluate the magnitude of the risk given the current conditions at a site
- Identify the primary causes of that risk
- Provide a decision as to whether a remedial response is necessary at the site or if a no further action determination is justified
- Focus the development of remediation action objectives and preliminary cleanup goals

4.1 RISK METHODOLOGIES TO BE USED IN THE RI AND FS

4.1.1 MEC HAZARD ASSESSMENT

Department of Navy participated with Department of Defense and USEPA toward development of a framework to objectively qualify and quantify the explosive hazards associated with MEC sites. The Interim MEC HA Methodology was developed by this team. The MEC HA supports the CERCLA nine-criterion evaluation and the associated remedy selection process. The MEC HA will be used at the end of the RI to determine the explosive hazards at the AOCs in support of the evaluation of remedial alternatives. The MEC HA will be used during the FS to conduct analyses of the level of protectiveness with respect to explosives hazards and the relative level of explosives hazard reduction that would be associated with the implementation of various remedial response alternatives for those AOCs indicated to pose an unacceptable explosives hazard in the RI.

4.1.2 MC RISK ASSESSMENT

An established CERCLA risk assessment (RA) framework has been applied at WVIA with respect to MC. This framework considers USEPA and HDOH requirements and established preferences in addition to U.S. Navy Human Health Risk Assessment Guidance (2008) and Navy Guidance for Conducting Ecological Risk Assessments (2003). The existing AOC-specific information and the AOC characterization results from the current RI field investigation program will be incorporated into these risk assessments. These same RA tools and protocols also will be used in the FS to evaluate the degrees of risk reduction afforded by the remedial response alternatives that may be considered with respect to MC associated with these areas.

4.2 APPLICATION OF HA AND RA TO DESIGN OF THE WORK PLAN

The data and information required to apply the MEC HA and the MC RA framework to the AOCs in this RI and FS were used to define the type, quantity, precision, and DQOs for a number of the data types to be collected during the RI field sampling program. The definitions of the various MEC HA hazard subfactors and components were used to identify the data gaps to be filled (in part) by field investigation. In addition, the applicable toxicity and risk-based screening criteria for MC in the various environmental media (e.g., soil, sediment) were examined to select the range of chemical analyses to be performed and to define the required analytical detection limits for these analyses. On a higher level, the CSM developed for the MRS and the associated exposure pathways were used to evaluate what type of exposure to MEC and MC might be most likely for each AOC and where these exposures may most likely occur. The RI field sampling program was designed to collect the field data needed to establish the MEC and MC site characteristics at these locations of potential current or future exposure.

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5.0 REMEDIAL INVESTIGATION REPORT

Upon completion of the field activities, an RI report will be generated. An internal draft, draft, draft final, and final version of the report will be prepared in accordance with the RI portion of the RI/FS format outlined in the *Department of Navy Environmental Restoration Program Manual* (DON 2006).

The internal draft, draft, and draft final RI portion of the RI report will be submitted separately. Agency concurrence on the draft final RI report will be secured before the internal draft FS is completed. USAE will prepare written response to comments on the internal draft, draft, and draft final documents.

- The RI report will present methods used for the RI, the results of the RI field program, the updated CSM resulting from the investigation, and the results of the MEC HA (see Section 6.0) along with recommendations for no further action, follow-on investigation, or FS as appropriate based upon data analysis.

Tables and maps will summarize the data for easy reference. At a minimum, the report will include the following tables and figures:

- A table listing all of the unresolved anomalies (anomalies below target depth) and their location
- Tables summarizing the results of the investigation
- Figures depicting the results of the investigation
- Figures showing the original AOC boundaries and the remediation boundaries (if different) that were developed as a result of analysis of the RI data

Agency concurrence on the final RI report will be secured. USAE will prepare written responses to comments on the internal draft, draft, and draft final documents. Comments will be resolved with the agencies as necessary to achieve concurrence on the final report. The deliverable schedule for these reports will be as outlined in the Navy scope of work.

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6.0 PROJECT MANAGEMENT

6.1 PROJECT STAFFING

The RI work activities will be managed by the contractor, and any subcontractors who perform work on site will report to the prime contractor and will be responsible for complying with the provisions of the RI Work Plan. The contractor's project team includes a number of key positions and associated responsibilities as outlined in the MEC SAP, the MC SAP, and APP. Some positions, roles, and responsibilities may be combined if the combination of responsibilities does not affect oversight, implementation of health and safety, or quality control requirements.

Office administration on site will be performed by one or more administrative staff personnel with responsibilities that include dedicated radio monitoring and communicating with the field staff for routine and emergency situations, as outlined in the APP.

6.2 COORDINATION

6.2.1 PROJECT TRACKING TOOLS

This project will be tracked on a daily basis while fieldwork is being conducted through the use of field logbooks, data entry forms, and electronic data loggers. Activities performed, personnel on site, equipment used, and areas of concern will be documented daily. Distribution of documentation is in accordance with the MEC SAP and MC SAP.

6.2.2 WEEKLY STATUS REPORTS

A Weekly Status Report will be issued to the USAE Project Manager by the close of business every Friday or the day before the next QC meeting, and will contain information current through the previous Friday. This report will discuss issues encountered and activities accomplished during the week as well as updated project scheduling and forecasting information. Input for these reports will be obtained from subcontractors, the Senior UXO Supervisor, and the contractor's accounting systems. A Health and Safety Inspection Report will also be generated weekly, following an inspection of the entire project site and office area.

6.2.3 WEEKLY STATUS MEETINGS

Site CQC meetings will be held with the Navy on a weekly basis. These meetings will be attended by the Project QC Manager, Site Manager, and lead technical staff as required. The USAE Project Manager will be teleconferenced for the meetings as required. Project status and planned activities will be addressed along with any concerns from the contractor, subcontractors, and the Navy.

6.2.4 MONTHLY PROGRESS REPORT

Project activities will be compiled and presented as part of the Monthly Progress Report to the Navy by the 10th of every following month. This report will consist of a written narrative describing all activities accomplished, activities planned, issues identified, and upcoming deliverables. The project schedule, updated by task, will be the final section of the Monthly Progress Report.

6.2.5 STATUS AND SCHEDULE REVIEW MEETINGS

As required, the USAE Project Manager and Navy Remedial Project Manager will consult by telephone to review progress from the previous week. Discussion will cover all phases of work, key milestones, schedule impacts, coordination issues, and personnel issues. All issues not addressed in the previous weekly report will be summarized and forwarded to the Navy Remedial Project Manager within 48 hours of the meeting. Project status will also be discussed during the weekly QC meetings.

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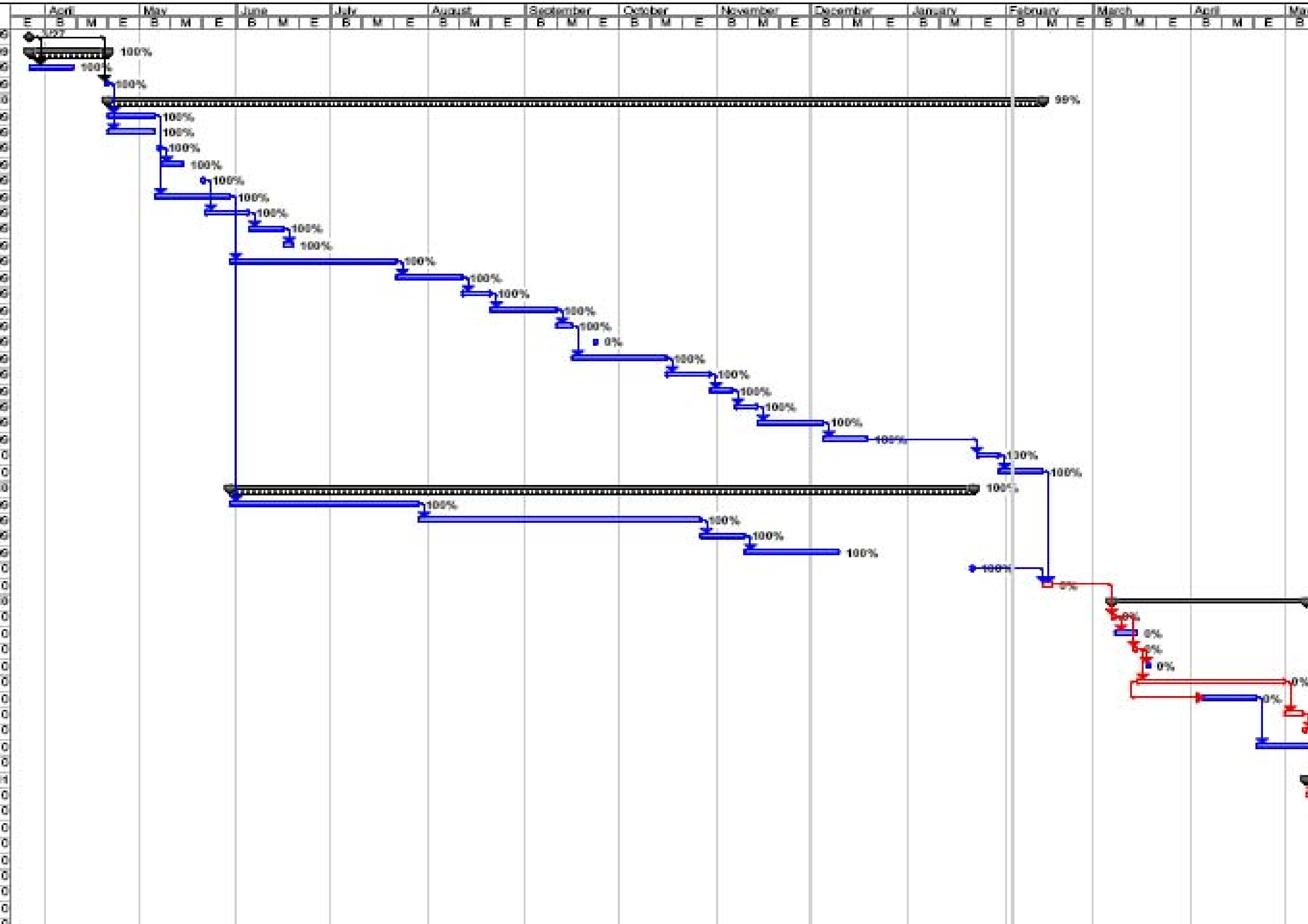
ID	Task Name	Start	Finish
1	Task Order Award	Fri 3/27/09	Fri 3/27/09
2	Meetings	Fri 3/27/09	Mon 4/20/09
3	Project Schedule	Fri 3/27/09	Thu 4/9/09
4	Scoping Meeting	Mon 4/20/09	Mon 4/20/09
5	RI Planning Documents	Tue 4/21/09	Fri 2/12/10
6	Pre-draft MC QAPP Worksheets	Tue 4/21/09	Tue 5/5/09
7	Pre-draft MEC QAPP Worksheets	Tue 4/21/09	Tue 5/5/09
8	MEC QAPP Teleconference	Thu 5/7/09	Thu 5/7/09
9	Draft Land Use CSM	Fri 5/8/09	Thu 5/14/09
10	MEC QAPP Teleconference 2	Thu 5/21/09	Thu 5/21/09
11	Pre-draft MC QAPP Worksheets 2	Wed 5/6/09	Fri 5/29/09
12	Pre-draft MEC QAPP Worksheets 2	Fri 5/22/09	Thu 6/4/09
13	Review In-Progress Draft QAPPs	Fri 6/5/09	Mon 6/15/09
14	Scoping Meeting MC & MEC QAPP	Tue 6/16/09	Thu 6/18/09
15	Preliminary Draft RI Work Plan	Sat 5/30/09	Tue 7/21/09
16	Navy/Marine Corps Internal Review	Wed 7/22/09	Tue 8/11/09
17	Response to Navy/Marine Corps Commen	Wed 8/12/09	Thu 8/20/09
18	Revision and Approval	Fri 8/21/09	Thu 9/10/09
19	Draft RI Work Plan	Fri 9/11/09	Tue 9/15/09
20	RAB Meeting	Wed 9/23/09	Wed 9/23/09
21	All Review & Comment	Wed 9/16/09	Thu 10/15/09
22	Response to Comments	Fri 10/16/09	Thu 10/29/09
23	Navy RPM Approval	Fri 10/30/09	Thu 11/5/09
24	Draft Final RI Work Plan	Sat 11/7/09	Fri 11/13/09
25	All Review & Comment	Sat 11/14/09	Fri 12/4/09
26	Response to Comments	Sat 12/5/09	Fri 12/18/09
27	Navy RPM Approval	Sat 1/23/10	Fri 1/29/10
28	Final RI Work Plan	Sat 1/30/10	Fri 2/12/10
29	Explosives Safety Submission	Sat 5/30/09	Thu 1/21/10
30	Draft ESS	Sat 5/30/09	Tue 7/28/09
31	MARCORSYSCOM Review	Wed 7/29/09	Mon 10/26/09
32	Final ESS	Tue 10/27/09	Mon 11/9/09
33	ESS Submittal to MARCORSYSCOM	Tue 11/10/09	Wed 12/9/09
34	ESS Approval	Thu 1/21/10	Thu 1/21/10
35	Notice to Proceed	Sat 2/13/10	Mon 2/15/10
36	RI Field Work	Sun 3/7/10	Fri 5/7/10
37	Mobilize Management Team	Sun 3/7/10	Sun 3/7/10
38	Site Preparation/Training	Mon 3/8/10	Sun 3/14/10
39	Mobilize Work Teams	Sun 3/14/10	Sun 3/14/10
40	RAB Site Visit	Thu 3/18/10	Thu 3/18/10
41	Conduct Surface Clearance	Mon 3/15/10	Fri 4/30/10
42	Collect Soil Samples	Mon 4/5/10	Wed 4/21/10
43	Subsurface Investigation	Sat 5/1/10	Thu 5/6/10
44	Demobilize	Fri 5/7/10	Fri 5/7/10
45	Lab Analysis	Thu 4/22/10	Fri 5/21/10
46	Lab Validation	Sat 5/22/10	Sat 6/5/10
47	RI Report	Sat 5/8/10	Tue 2/15/11
48	Prelim Draft RI Report	Sat 5/8/10	Tue 7/6/10
49	Navy/Marine Corps Internal Review	Wed 7/7/10	Thu 8/5/10
50	Response to Navy/Marine Corps Commen	Fri 8/6/10	Thu 8/19/10
51	Navy RPM Approval	Fri 8/20/10	Thu 8/26/10
52	Draft RI Report	Fri 8/27/10	Thu 9/16/10
53	Navy Review & Comment	Fri 9/17/10	Thu 10/7/10
54	Response to Comments	Fri 10/8/10	Thu 10/21/10
55	Navy RPM Approval	Fri 10/22/10	Thu 10/28/10
56	Draft Final RI Report	Fri 10/29/10	Thu 11/18/10



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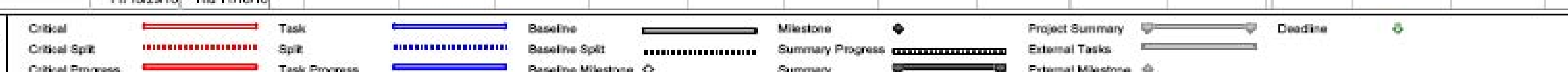

Figure 6-1: Schedule

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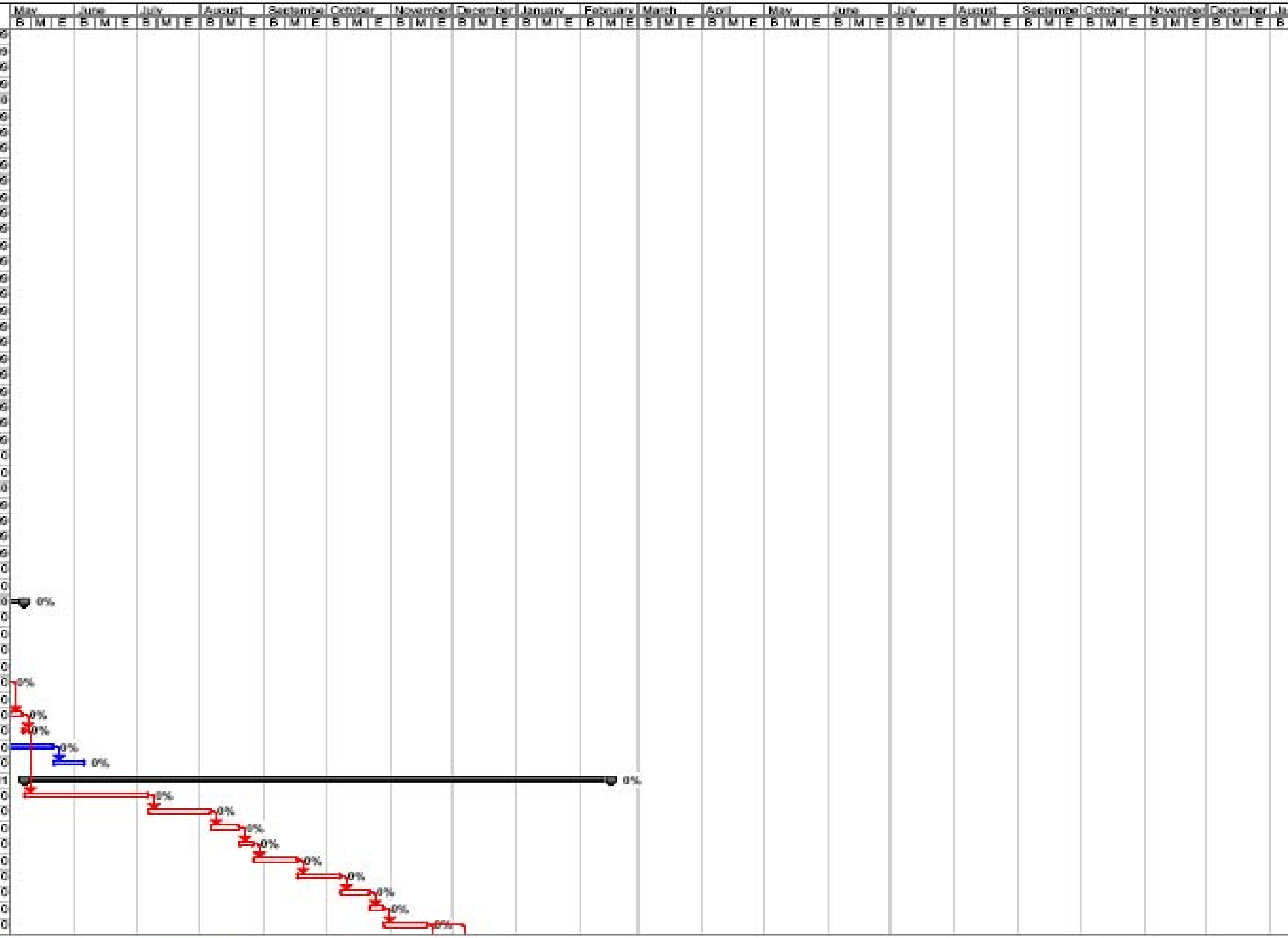

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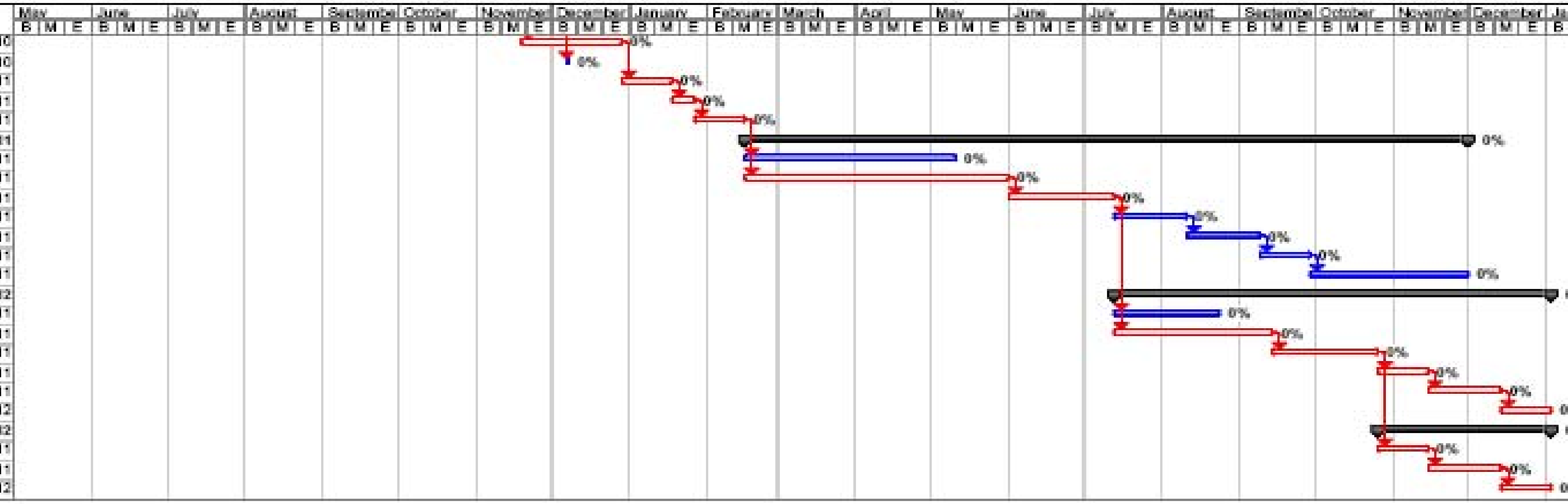
Critical, Critical Split, Critical Progress, Task, Split, Task Progress, Baseline, Baseline Split, Baseline Milestone, Milestone, Summary Progress, Summary, Project Summary, External Tasks, External Milestone, Deadline

Figure 6-1: Schedule

ID	Task Name	Start	Finish
57	Public Review & Comment	Fri 11/19/10	Tue 12/28/10
58	Public Meeting	Tue 12/7/10	Tue 12/7/10
59	Response to Comments	Wed 12/29/10	Mon 1/17/11
60	Navy RPM Approval	Tue 1/18/11	Wed 1/26/11
61	Final RI Report	Thu 1/27/11	Tue 2/15/11
62	FS Report	Wed 2/16/11	Wed 11/30/11
63	Prelim Draft FS Report	Wed 2/16/11	Tue 5/10/11
64	Draft FS Report	Wed 2/16/11	Tue 5/31/11
65	Navy Review & comment	Wed 6/1/11	Tue 7/12/11
66	Draft Final FS Report	Wed 7/13/11	Wed 8/10/11
67	All Review & Comment	Thu 8/11/11	Thu 9/8/11
68	Final FS Report	Fri 9/9/11	Wed 9/28/11
69	Public Review	Thu 9/29/11	Wed 11/30/11
70	Proposed Plan	Wed 7/13/11	Mon 1/2/12
71	Prelim Draft Proposed Plan	Wed 7/13/11	Tue 8/23/11
72	Draft Proposed Plan	Wed 7/13/11	Tue 9/13/11
73	Navy Review & Comment	Wed 9/14/11	Tue 10/25/11
74	Draft Final Proposed Plan	Wed 10/26/11	Mon 11/14/11
75	All Review & Comment	Tue 11/15/11	Tue 12/13/11
76	Final Proposed Plan	Wed 12/14/11	Mon 1/2/12
77	Decision Document	Wed 10/26/11	Mon 1/2/12
78	Draft Final Decision Document	Wed 10/26/11	Mon 11/14/11
79	Navy Review & Comment	Tue 11/15/11	Tue 12/13/11
80	Final Decision Document	Wed 12/14/11	Mon 1/2/12



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Critical | Critical Split | Critical Progress | Task | Split | Task Progress | Baseline | Baseline Split | Baseline Milestone | Milestone | Summary Progress | Summary | Project Summary | External Tasks | External Milestone | Deadline

Figure 6-1 Schedule

7.0 REFERENCES

The following are references applicable to this project, but are not all-inclusive. USAE will comply with applicable Federal, State, and local requirements. Following all applicable requirements and regulations listed in the following publications will ensure the safety and health of onsite personnel and the local community.

7.1 FEDERAL REGULATIONS

Code of Federal Regulations (CFR) 40 CFR 300.430 National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 1993.

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

7.2 NAVY REGULATIONS AND INSTRUCTIONS

- *Environmental Restoration Program Manual,* 2006.
- Human Health Risk Assessment Guidance, December 2008
- Navy Guidance for Conducting Ecological Risk Assessments

7.3 DEPARTMENT OF DEFENSE PUBLICATIONS

- Department of Defense Explosives Safety Board TP-18, *Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel*
- Ammunition and Explosives Safety Standards 6055.9-STD, Feb 29, 2008; Incorporating Change 2, August 21, 2009

7.4 OTHER DOCUMENTATION

- AECOS Consultants. 2003. *Biological resources report for a proposed Marine Corps Jungle Warfare Training Area in Waikane Valley on windward Oahu.* September.
- Belt Collins & Associates, 1990. *Final Environmental Assessment for Fencing/Warning Signs and Demolition Work for FY87 MCON Project P-106, Land Acquisition, Waikane, Oahu*, Hawaii. July.
- Tuggle, H.D. and Bruce A. Wilcox. 1998. *Strategic Integrated Resources Management Planning for Selected Properties of Marine Corps Base Hawaii: Camp H.M. Smith, Puuloa Training Facility, and a Portion of Waikane Valley.* October.
- Marine Corps Base Hawaii. 2004. *Draft Environmental Assessment (EA) for the Proposed United States Marine Corps (USMC) Jungle Warfare Training Waikane Valley, Oahu, Hawaii.* September.
- United States Army Engineering and Support Center, Huntsville. 2006. *Draft Engineering Evaluation/Cost Analysis (EE/CA) Report, Former Waikane Valley Training Area, Island of Oahu, Hawaii.*
- United States Department of Agriculture, Soil Conservation Service (USDA SCS), *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawai*i. In cooperation with the University of Hawaii Agricultural Experiment Station, August 1972.
- USEPA *Data Quality Objectives Process for Hazardous Waste Site Investigations*, USEPA QA/G-4HW (EPA 600-R-00-007) (USEPA 2000)

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APPENDIX A. SITE MAPS AND DRAWINGS

This appendix contains the following maps for the Munitions Response Site at the Waikane Valley Impact Area:

- Figure A-1: Location Map
- Figure A-2: Grid/Transect Map
- Figure A-3: CSM for Land Use
- Figure A-4: CSM of Exposure Pathways (Graphic)
- Figure A-5: CSM of Exposure Pathways (3-Dimensional)
- Figure A-6: Investigative Transects Map
- Figure A-7: MSD Map.

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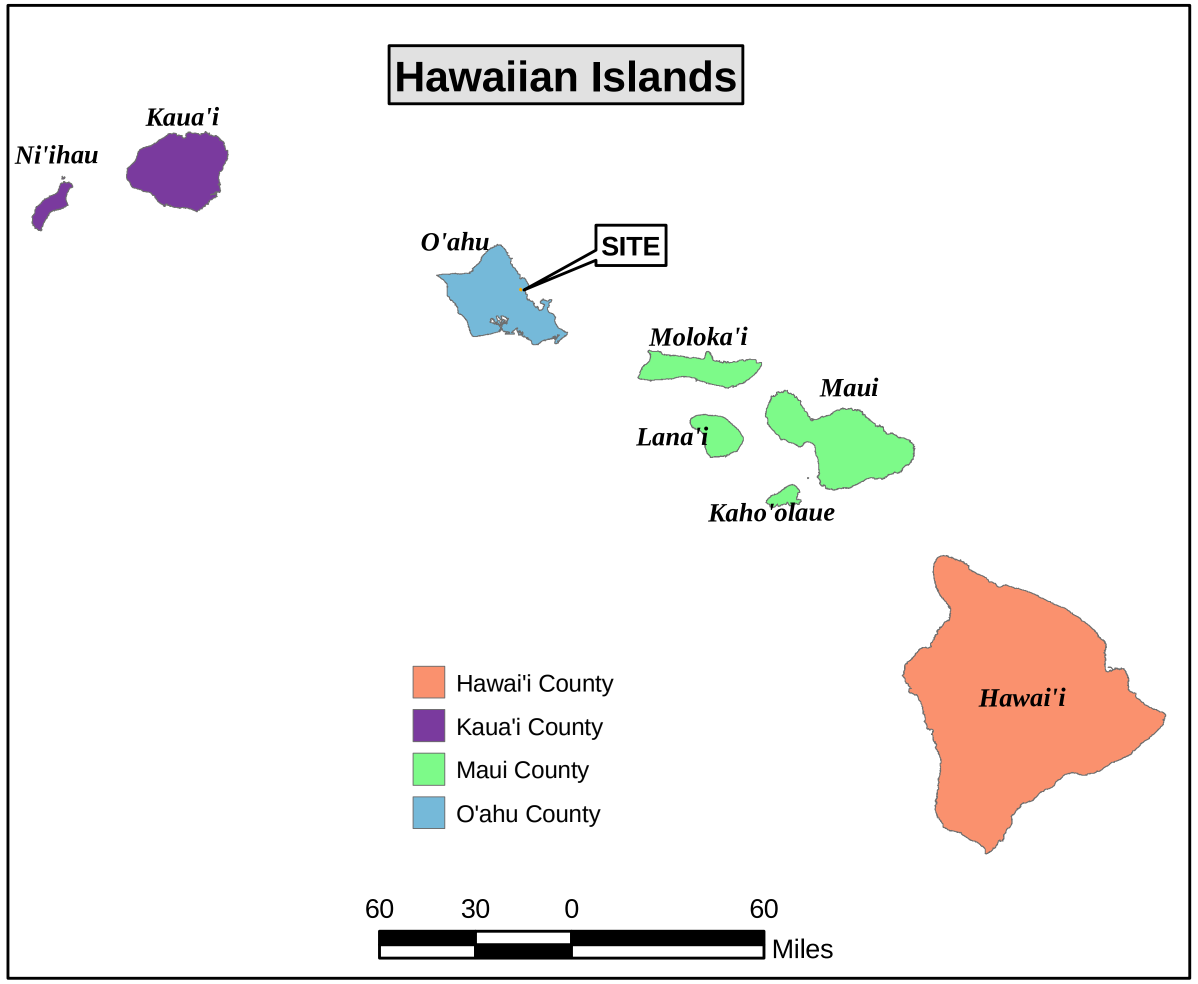
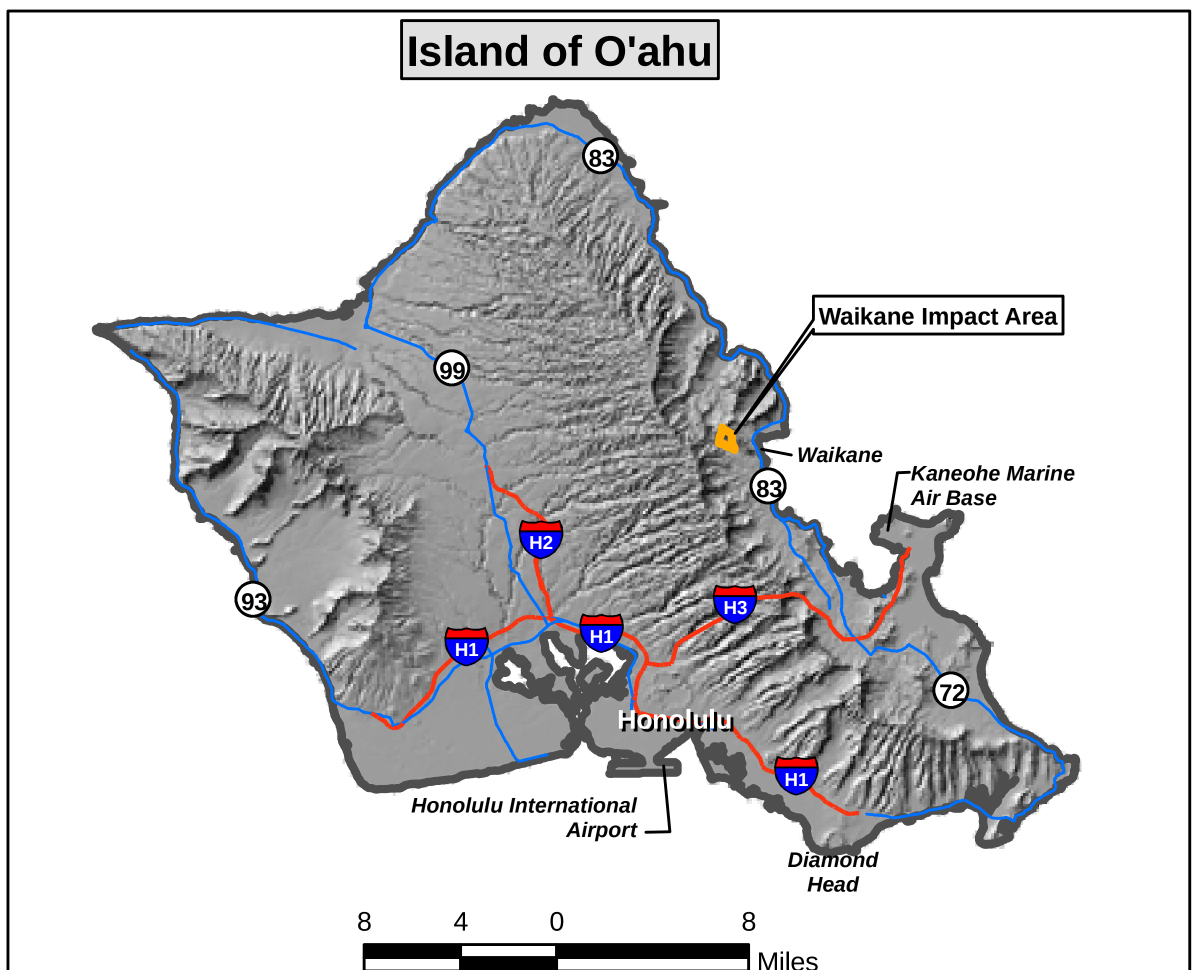
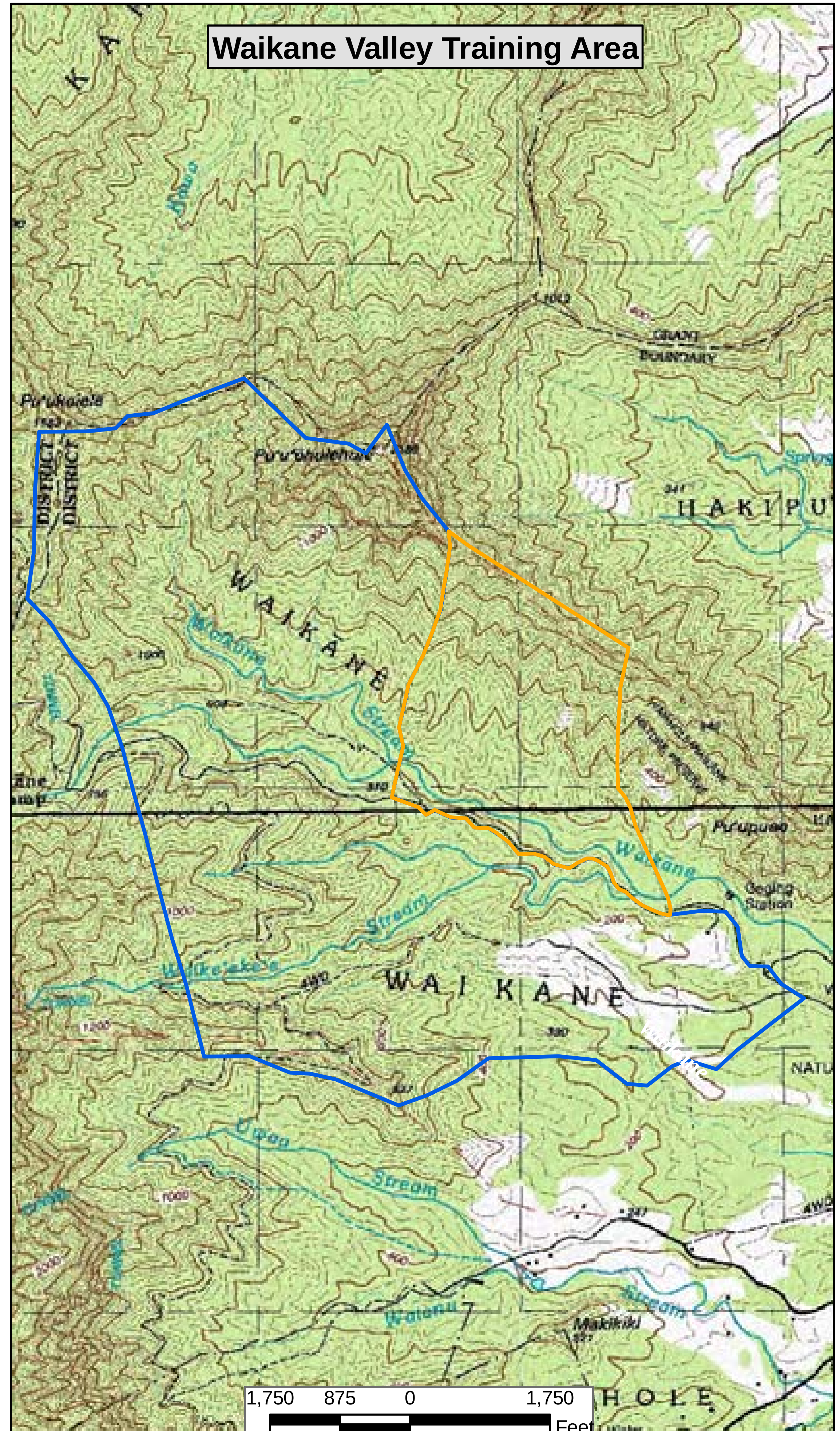






N

Data is projected to the State Plane Coordinate System: Hawaii 4 Zone, NAD83, Units in Feet.

Figure A-1

Location Map

Waikane Valley Impact Area
Koolaupoko District, O'ahu, Hawai'i

Legend

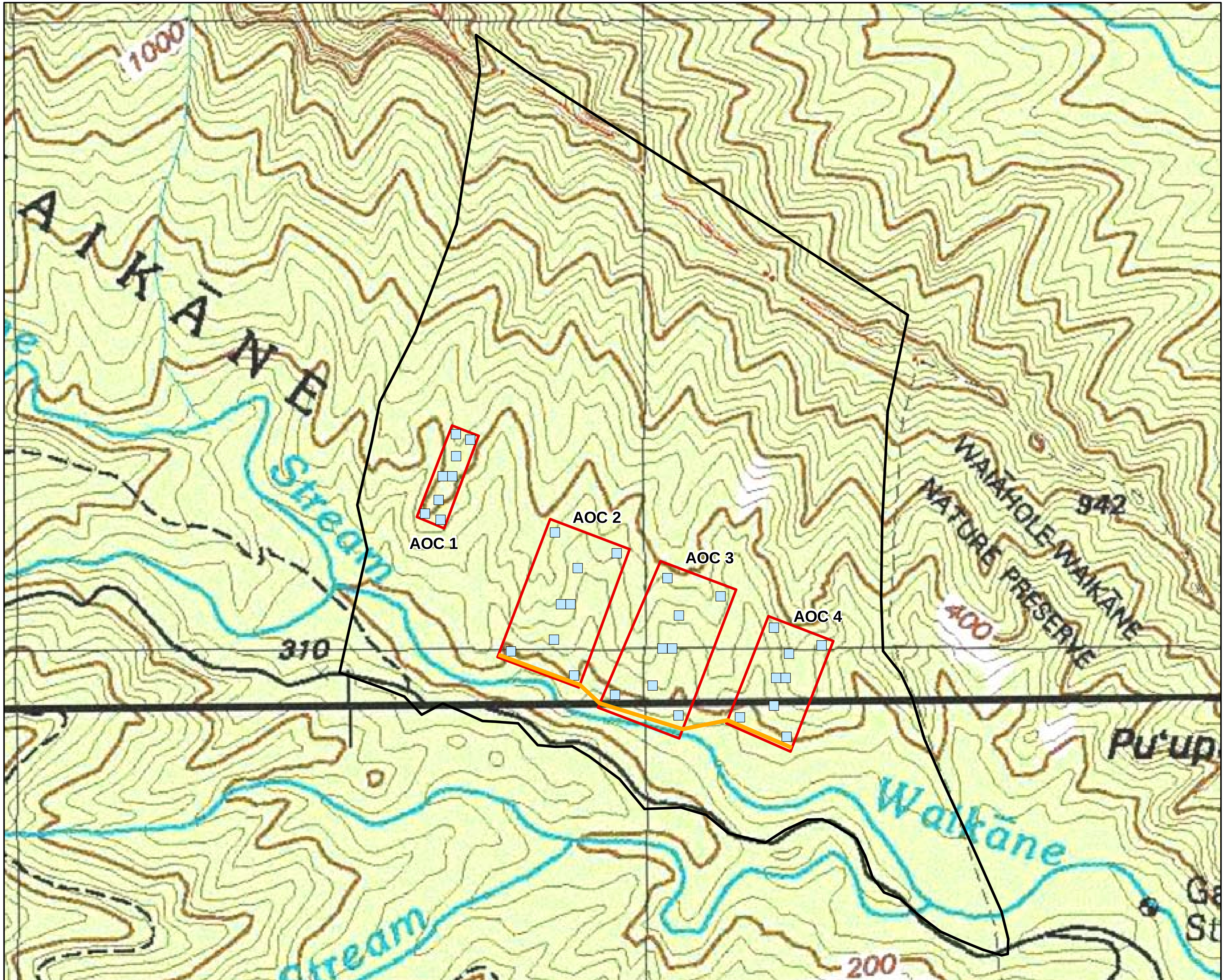
- Impact Area Boundary
- Waikane FUDS Boundary

USA Environmental, Inc.

NAVFAC

Drawn By:	JAL	Scale:	Varies	Rev:
Checked By:		Date Drawn:	12-10-2008	
Submitted By:	RN	Revision Date:		

Path: S:\Waikane\Work Plan\Location.mxd



N

500 250 0 500

Feet

Data is projected to the State Plane Coordinate System: Hawaii 4 Zone, NAD83, Units in Feet.

Figure A-2

Grid/Transect Map

Waikane Valley Impact Area
Koolaupoko District, O'ahu, Hawai'i

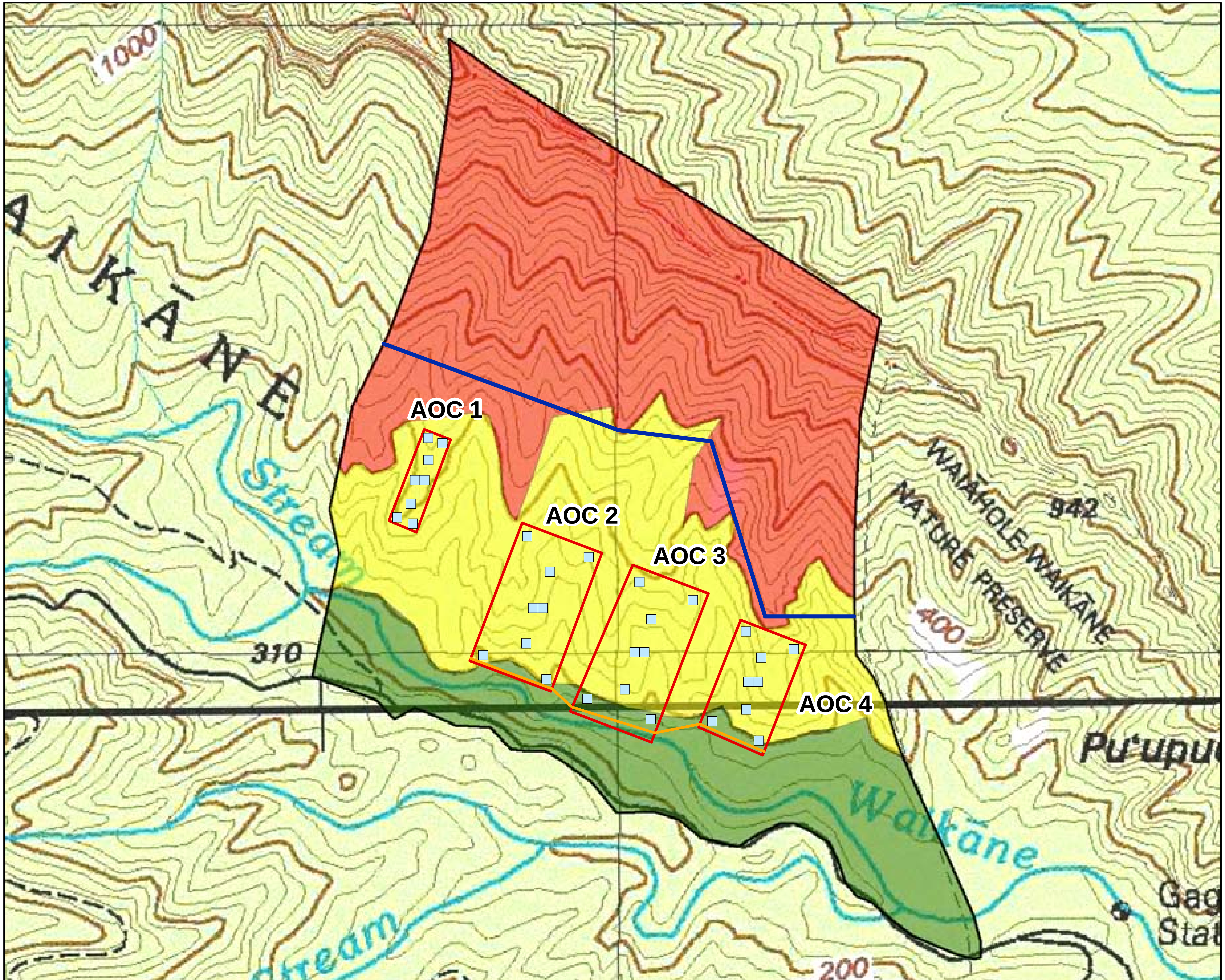
Legend

- Intrusive Transect
- 50ft Grids
- Suspected Target Locations
- Waikane Boundary

USA Environmental, Inc.

NAVFAC

Drawn By:	JAL	Scale:	1 inch = 500 feet	Rev:	
Checked By:	DM	Date Drawn:	6-9-2009		
Submitted By:	RN	Revision Date:			
	Path: S:\Waikane\Work Plan\Grid Map.mxd				



N

500 250 0 500

Feet

Data is projected to the State Plane Coordinate System: Hawaii 4 Zone, NAD83, Units in Feet.

Figure A-3

Conceptual Site Model For Land Use

Waikane Valley Impact Area
Koolaupoko District, O'ahu, Hawai'i

Legend

- Approximate 30 Degree Slope Line
- Intrusive_Transect
- 50ft Grids
- Suspected Target Locations

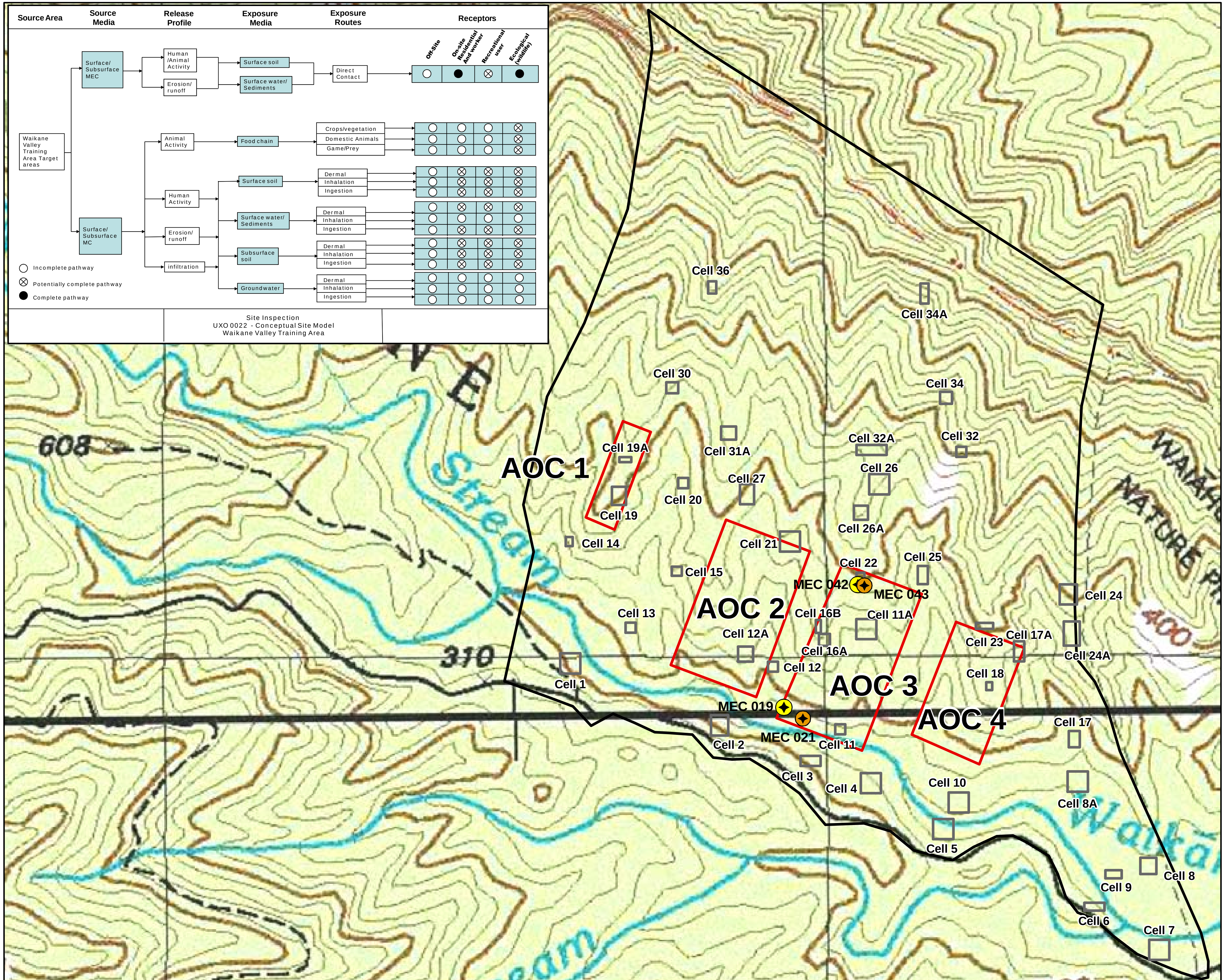
Proposed Land Use

- Inaccessible
- Recreational
- Residential
- Waikane Boundary

USA Environmental, Inc.

Drawn By:	JAL	Scale:	1 inch = 500 feet	Rev:
Checked By:	DM	Date Drawn:	6-9-2009	
Submitted By:	RN	Revision Date:		

Path: S:\Waikane\Work Plan\CSM Land Use Map.mxd



N

475 237.5 0 475

Feet

Data is projected to the State Plane Coordinate System: Hawaii 4 Zone, NAD83, Units in Feet.

Figure A-4

Conceptual Site Model

Waikane Valley Training Area
Koolaupoko District, O'ahu, Hawai'i

Legend

Soil Sample Locations

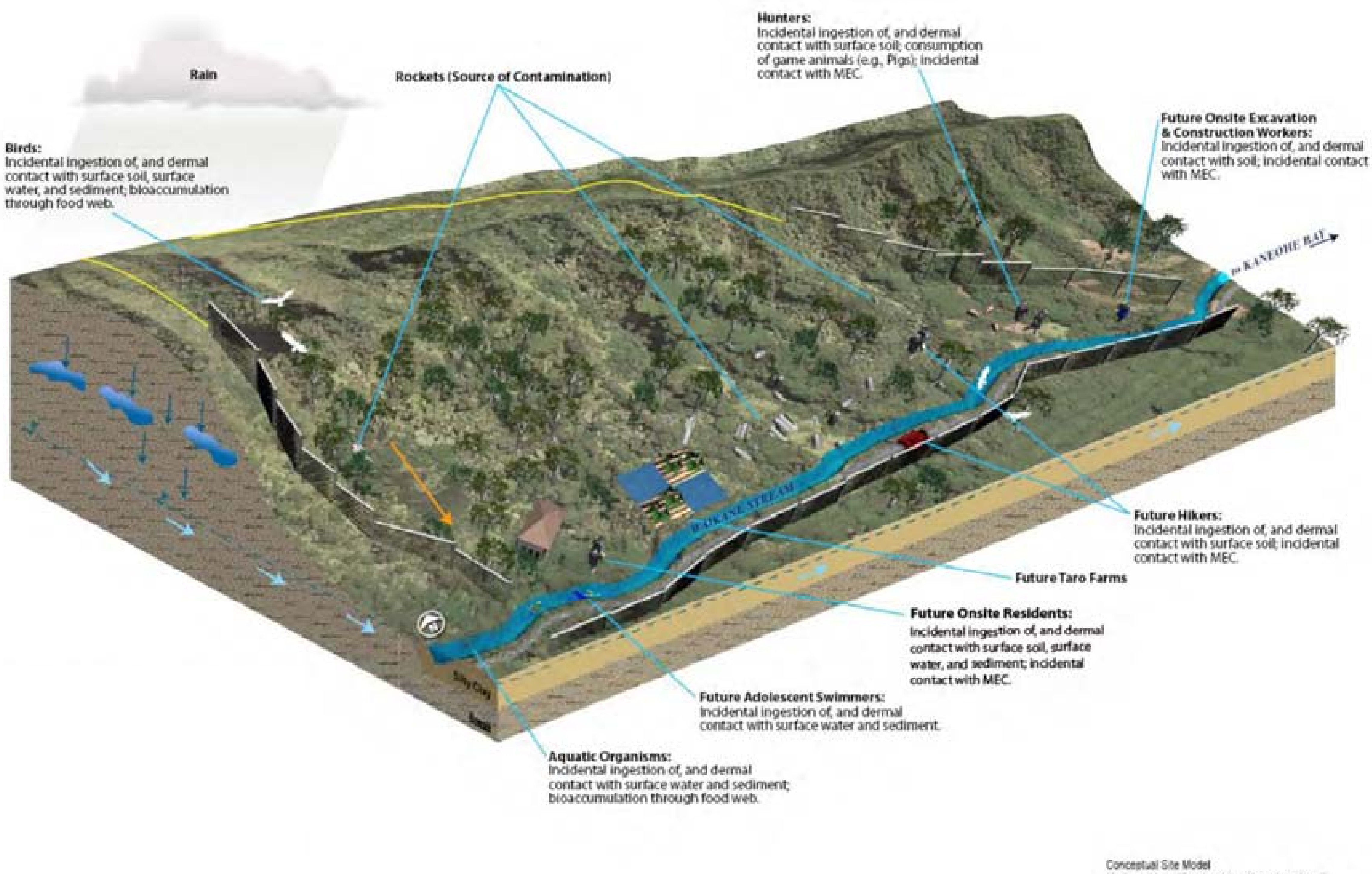
- Exceeded criteria for Copper
- Exceeded criteria for Copper and Lead
- Cell Locations
- Suspected Target Locations
- Waikane Boundary

USA Environmental, Inc.

NAVFAC

Drawn By:	JAL	Scale:	1 inch = 475 feet	Rev:	1
Checked By:	DM	Date Drawn:	12-16-2008		
Submitted By:	RN	Revision Date:	5-13-2009		

Path:
S:\Waikane\CSM Map.mxd



N

Not To Scale

Data is projected to the UTM Coordinate System:
Zone 15 North, NAD83, Units in Meters.

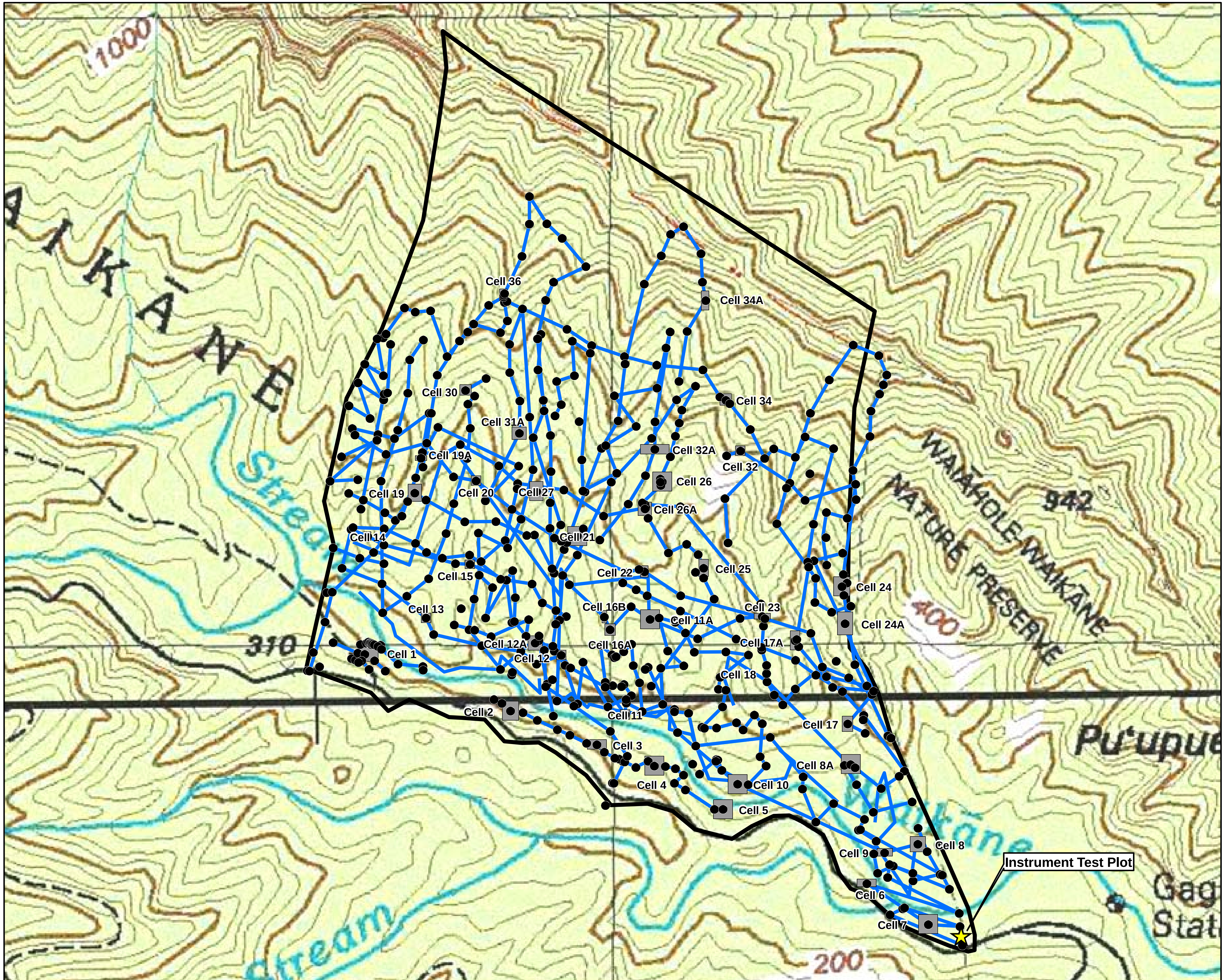
Figure A-5

Conceptual Site Model of Exposure Pathways

Waikane Valley Training Area
Koolaupoko District, O'ahu, Hawai'i

USA Environmental, Inc.

Drawn By:	JAL	Scale:	Not To Scale	Rev:	
Checked By:		Date Drawn:	4-30-2008		
Submitted By:	RN	Revision Date:			
Path:	S:\Waikane\Conceptual Site Model.mxd				



N

500 250 0 500

Feet

Data is projected to the State Plane Coordinate System: Hawaii 4 Zone, NAD83, Units in Feet.

Figure A-6

Investigative Transect Map

Waikane Valley Impact Area
Koolaupoko District, O'ahu, Hawai'i

Legend

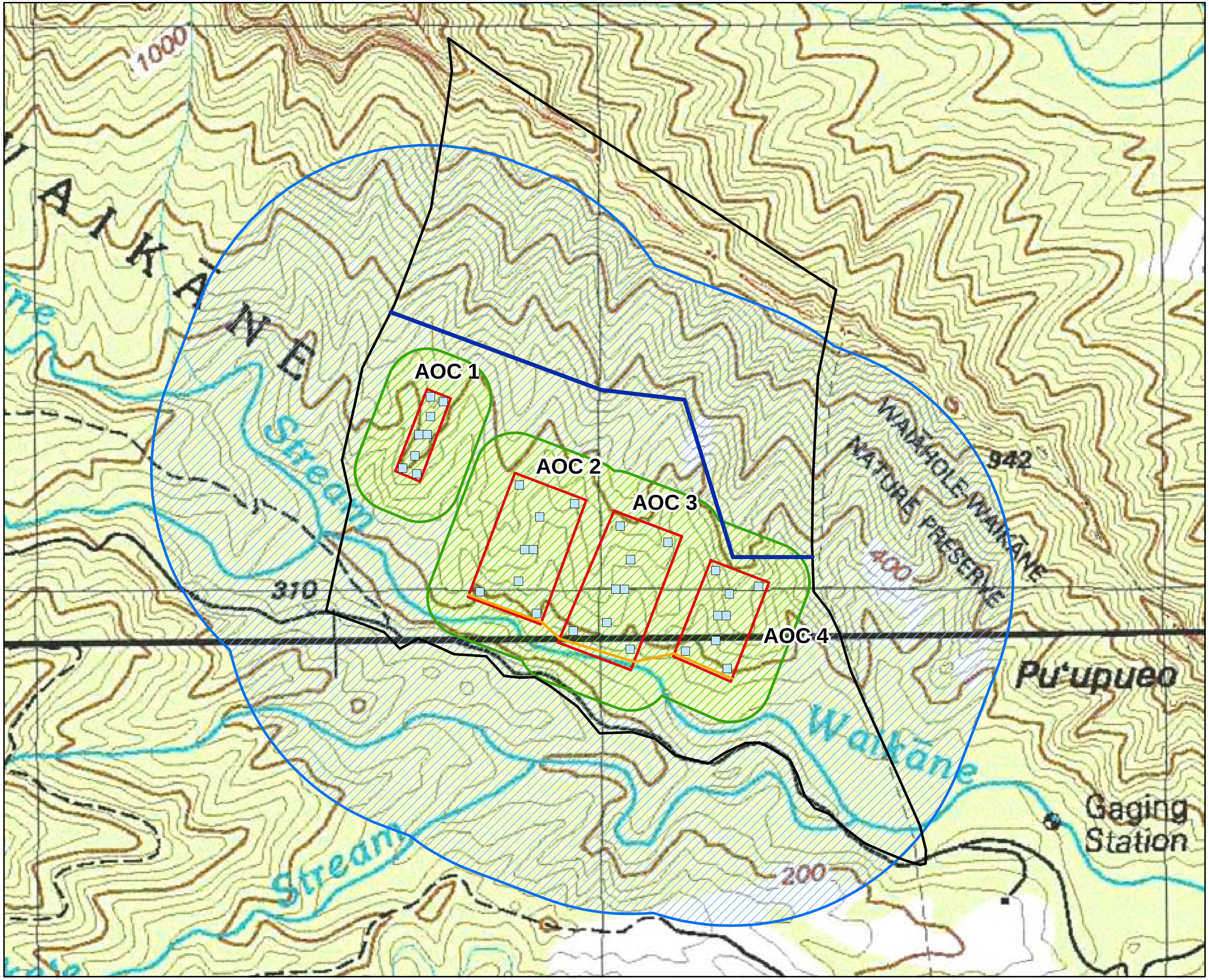
- Recon Data Points
- Traversed Track (9.5 ac.)
- Cell Locations (5.2 ac.)
- Waikane Boundary

USA Environmental, Inc.

NAVFAC

Drawn By:	JAL	Scale:	1 inch = 500 feet	Rev:
Checked By:	DM	Date Drawn:	12-16-2008	
Submitted By:	RN	Revision Date:		

Path:
S:\Waikane\Work Plan\Investigative Transect map.mxd



N

550 275 0 550

Feet

Data is projected to the State Plane Coordinate System: Hawaii 4 Zone, NAD83, Units in Feet.

Figure A-7

MSD Map

Waikane Valley Impact Area
Koolaupoko District, O'ahu, Hawai'i

Legend

- Approximate 30 Degree Slope Line
- Intrusive Transect
- 50ft Grids
- Suspected Target Locations
- Waikane Boundary

3.5" M28 HEAT Rocket MSD

- 235 ft HFD
- 1420 ft MFR

USA Environmental, Inc.

Drawn By:	JAL	Scale:	1 inch = 550 feet	Rev:	
Checked By:	DM	Date Drawn:	6-9-2009		
Submitted By:	RN	Revision Date:			

Path: S:\Waikane\Work Plan\MSDMap.mxd

APPENDIX B. MEC SAMPLING AND ANALYSIS PLAN (SAP)

This appendix contains the MEC SAP for this project.

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FINAL

MUNITIONS AND EXPLOSIVES OF CONCERN SAMPLING AND ANALYSIS PLAN (SAP)

WAIKANE VALLEY IMPACT AREA (UXO-0022)

KANEOHE, HAWAI'I

Naval Facilities Engineering Command

February 2010

Prepared For:
Department of the Navy
Naval Facilities Engineering Command Pacific
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Prepared By:
USA Environmental, Inc.
720 Brooker Creek Boulevard
Suite 204
Oldsmar, FL 34677

Prepared Under:
Munitions Response Contract (MRC) for Worldwide Sites
Contract Number N62742-05-D-1868

EXECUTIVE SUMMARY

This Munitions and Explosives of Concern (MEC) Sampling and Analysis Plan (SAP) has been prepared to support the Remedial Investigation/Feasibility Study (RI/FS) of the Waikane Valley Impact Area (WVIA) located near Kaneohe, Hawai'i. USA Environmental, Inc. (USAE) prepared this SAP for Naval Facilities Engineering Command Pacific (NAVFAC PAC) under Contract N62742-05-D-1868.

The RI consists of a surface clearance and subsurface investigation to determine the extent of hazard associated with MEC and Munitions Constituents (MC). As the result of previous investigations, five Areas of Concern (AOC) have been identified for further investigation. The area along Waikane Stream is identified as an AOC because it is located down-gradient of the other four AOCs and has a potential for MC migration from the targets. The other four AOCs are target areas, which are being investigated because of the presence of MEC and the potential presence of MC.

The information collected during this RI will aid in the selection of areas to be further evaluated, remediated, or approved for no further action by the WVIA Project Team (Project Team) if it is agreed these areas do not pose an unacceptable level of risk to human health and the environment. The Project Team working on the RI effort currently comprises individuals from the Navy, the U.S. Environmental Protection Agency (EPA) Region 9, and Hawaii Department of Health (HDOH). The Project Team participants vary depending on the nature of the issues at hand, and other stakeholders may be (or may have been in the past) active in the team process or meetings.

This SAP, including the Standard Operating Procedures (SOPs) located at the end of the SAP, is one of the planning documents for WVIA contained in the Work Plan. This SAP documents the project organization, specific procedures for the execution of the work, quality control, and the assessment and oversight planning that will help ensure the quality of the remediation. Other plans incorporated in the Work Plan (and referenced in the MEC SAP) include the Accident Prevention Plan (APP) as well as the MC Sampling and Analysis Plan (MC SAP), Quality Control Plan (QCP), and Environmental Protection Plan.

The site descriptions of AOCs, their backgrounds and previous investigations and actions, and a project schedule are located in the Work Plan.

The format of the MEC SAP is based on the Uniform Federal Policy (UFP) for QAPP, which was designed specifically for chemical sampling. The worksheets in the UFP QAPP have been modified to meet the intent of the worksheet as it applies to MEC.

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ACRONYMS AND ABBREVIATIONS

AOC	area of concern
BIP	blow in place
bgs	below ground surface
BRAC	Base Realignment and Closure
BSI	blind seed item
CA	corrective action
CERCLA	Comprehensive Environmental Response, Conservation, and Liability Act
CFR	Code of Federal Regulations
CSIR	Contractor Serious Incident Report
CSM	Conceptual Site Model
DCN	Design Change Notice
DDESB	Department of Defense Explosives Safety Board
DEI	Donaldson Enterprises International, Inc.
DFW	definable feature of work
DGPS	differential global positioning system
DGM	digital geophysical mapping
DN	Deficiency Notice
DoD	U.S. Department of Defense
DQO	data quality objective
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ESQD	explosive safety quantity distance
EZ	exclusion zone
FCR	Field Change Request
ft	feet
FS	Feasibility Study
HA	Hazard Assessment
HDOH	Hawaii Department of Health
HE	high explosive
HEAT	high explosive anti-tank
HFD	hazardous fragmentation distance
IAW	in accordance with
in	inch
ITS	instrument test strip
MC	munitions constituents
MDAS	material documented as safe
MDEH	material documented as an explosive hazard
MEC	munitions and explosives of concern
MFD	maximum fragmentation distance
MGFD	munition with greatest fragmentation distance
MPPEH	material potentially presenting an explosive hazard
m	meter
mm	millimeter
mV	milli-Volt
NA	not applicable
NAVFAC ESC	Naval Facilities Engineering Command Environmental Services Center
NAVFAC LANT	Naval Facilities Engineering Command Atlantic
NAVFAC PAC	Naval Facilities Engineering Command Pacific
Navy	U.S. Navy
NCR	Nonconformance Report
NEW	net explosive weight

NOSSA	Naval Ordnance Safety and Security Activity
NTR	Navy Technical Representative
Pd	probability of detection
PLS	Professional Land Surveyor
PE	performance evaluation
PM	Project Manager
PHSM	Project Health and Safety Manager
POSM	Program Occupational Safety Manager
PPE	personal protective equipment
PQCM	Program Quality Control Manager
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SI	Site Inspection
SOP	Standard Operating Procedure
SUXOS	Senior UXO Supervisor
TBD	to be determined
UFP-QAPP	Uniform Federal Policy for Quality Assurance Project Plans
USACE	U.S. Army Corps of Engineers
USAE	USA Environmental, Inc.
UXO	unexploded ordnance
UXOQCS	UXO Quality Control Specialist
UXOSO	UXO Safety Officer
WP	Work Plan
WS	Work Sheet
WVIA	Waikane Valley Impact Area

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SAP WORKSHEETS

Executive Summary

Acronyms and Abbreviations

Worksheet #1: Title and Approval Page

Worksheet #2: SAP Identifying Information

Worksheet #3: Distribution List

Worksheet #4: Project Personnel Sign-Off Sheet

Worksheet #5: Project Organizational Chart

Worksheet #6: Communication Pathways

Worksheet #7: Personnel Responsibilities and Qualifications Table

Worksheet #8: Special Personnel Training Requirements Table

Worksheet #9: Project Scoping Session Participants Sheets

Worksheet #10: Problem Definition

Worksheet #11: Project Quality Objectives/Systematic Planning Process Statements

Worksheet #12: Measurement Performance Criteria

Worksheet #13: Secondary Data Criteria and Limitations Table

Worksheet #14: Summary of Project Definable Features of Work

Worksheet #15: Reference Limits and Evaluation Table (NOT APPLICABLE)

Worksheet #16: Project Schedule/Timeline Table

Worksheet #17: Sampling Design and Rationale

Worksheet #18: Sampling Locations and Methods/SOP Requirements Table

Worksheet #19: Analytical SOP Requirements Table (NOT APPLICABLE)

Worksheet #20: Field Quality Control Sample Summary Table

Worksheet #21: Project Sampling SOP References Table

Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Worksheet #23: Analytical SOP References Table (NOT APPLICABLE)

Worksheet #24: Analytical Instrument Calibration Table (NOT APPLICABLE)

Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table (NOT APPLICABLE)

Worksheet #26: Material Potentially Presenting an Explosive Hazard (MPPEH) Management

Worksheet #27: Sample Custody Requirements (NOT APPLICABLE)

Worksheet #28: QC Samples Table (NOT APPLICABLE)

Worksheet #29: Project Documents and Records Table

Worksheet #30: Analytical Services Table (NOT APPLICABLE)

Worksheet #31: Planned Project Assessments Table

Worksheet #32: Change Control Management

Worksheet #33: QC Management Reports Table

Worksheet #34: Verification (Tier 1) Process Table – Preparatory and Initial Inspections

Worksheet #35: Tier 2 Process Summary Table

Worksheet #36: Product QC Tier 3 Process Summary

Worksheet #37: Usability Assessment – AOC Certification Checklist

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SAP WORKSHEET #1: TITLE AND APPROVAL PAGE

Final
Munitions and Explosives of Concern Sampling and Analysis Plan
Prepared February 2010

Remedial Investigation for Waikane Valley Impact Area

Kaneohe, Oahu, Hawaii

Prepared for:

Naval Facilities Engineering Command Pacific
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Prepared by:

USA Environmental, Inc.
720 Brooker Creek Blvd., Suite 204
Oldsmar, FL 34677
rnore@usatampa.com, tel. 256-684-9791

Prepared under:

Contract Number N62742-05-D-1868
Task Order No. 0010

Review Signatures:

Lance Higa/Navy RPM/Date

Robert Nore/USAE Project Manager/Date

Thomas Bernitt/USAE Project QC Manager/Date

Approval Signatures:

NAVFAC QAO/UXO III Technician

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WORKSHEET #2: SAP IDENTIFYING INFORMATION

Site Name/Number: Waikane Valley Impact Area, UXO 0022

Operable Unit:

Contract Title: Remedial Investigation/Feasibility Study

Contractor Name: USA Environmental, Inc.

Contract Number: N62742-05-D-1868

1. Identify guidance used to prepare SAP: *Uniform Federal Policy for Quality Assurance Project Plans* (UFP-QAPP)(U.S. EPA 2005); and *EPA Guidance for Quality Assurance Project Plans* (EPA QA/G-5) (EPA 2002); *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4 2006) (EPA 2006)

2. Identify regulatory program: Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

3. This SAP is a project-specific SAP.

4. List dates of scoping sessions that were held: May 5, 2009; May 21, 2009; June 5, 2009

5. List dates and titles of SAP documents written for previous site work that are relevant to the current investigation:

Title	Date
Site Inspection Work Plan, Munitions Response Sites, Waikane Valley Training Area, Kaneohe, Hawaii (USAE 2008)	May 2008
Preliminary Range Assessment Report and Archive Search Report for Waikane Valley Training Area. (USACE 1998)	1998
DERP-FUDS Inventory Project Report, Waikane Training Area, Island of Oahu, Hawaii, Site No. H09H1035400 (USACE 1996)	May, 1996

6. List organizational partners (stakeholders) and connection with lead organization:

Organization Partners / Stakeholders	Role
Naval Facilities Engineering Command (NAVFAC), Hawaii	Lead Agency and Land Users
Marine Corps Base of Hawaii, Kaneohe (MCBH)	Land Users
State of Hawaii Department of Health (DOH)	State Regulatory Agency
USA Environmental, Inc. (USAE)	Navy Contractor

7. Lead organization (see WS 7 for detailed list of data users):

NAVFAC PAC (Lance Higa, RI/FS Project Manager)

8. If any required SAP elements or required information are not applicable to the project or are provided elsewhere, then circle the omitted SAP elements and provide an explanation for their exclusion below: The SAP worksheets that are not applicable to MEC projects are as follows: 13, 15, 18, 19, 20, 23, 24, 25, 27, 28, 29, 30, and 32. Since the UFP QAPP is a chemical quality plan for sampling and analysis, these sections were identified as N/A for MEC processes.

UFP-QAPP Worksheet #	Required Information	Included or Excluded
A. Project Management		
Documentation		
1	Title and Approval Page	**Included**
2	Table of Contents SAP Identifying Information	**Included**
3	Distribution List	**Included**
4	Project Personnel Sign-Off Sheet	**Included**
Project Organization		
5	Project Organizational Chart	**Included**
6	Communication Pathways	**Included**
7	Personnel Responsibilities and Qualifications Table	**Included**
8	Special Personnel Training Requirements Table	**Included**
Project Planning/Problem Definition		
9	Project Planning Session Documentation (including Data Needs tables) Project Scoping Session Participants Sheet	**Included**
10	Problem Definition, Site History, and Background. Site Maps (historical and present)	**Included**
11	Site-Specific Project Quality Objectives	**Included**
12	Measurement Performance Criteria Table	**Included**
13	Sources of Secondary Use Data and Information Secondary Use of Data Criteria and Limitations Table	**Included**
14	Summary of Project Tasks	**Included**
15	Reference Limits and Evaluation Table	**Excluded**
16	Project Schedule/Timeline Table	**Included**
B. Measurement Data Acquisition		
Sampling Tasks		
17	Sampling Design and Rationale	**Included**
18	Sampling Locations and Methods/ SOP Requirements Table Sample Location Map(s)	**Included**
19	Analytical Methods/SOP Requirements Table	**Excluded**
20	Field Quality Control Sample Summary Table	**Included**
21	Project Sampling SOP References Table Sampling SOPs	**Included**
22	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	**Included**
Analytical Tasks		
23	Analytical SOPs Analytical SOP References Table	**Excluded**
24	Analytical Instrument Calibration Table	**Excluded**
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	**Excluded**
Sample Collection		
26	Sample Handling System, Documentation Collection, Tracking, Archiving and Disposal Sample Handling Flow Diagram	**Included**
27	Sample Custody Requirements, Procedures/SOPs Sample Container Identification Example Chain-of-Custody Form and Seal	**Excluded**
Quality Control Samples		

UFP-QAPP Worksheet #	Required Information	Included or Excluded
28	QC Samples Table Screening/Confirmatory Analysis Decision Tree	**Excluded**
Data Management Tasks		
29	Project Documents and Records Table	**Included**
30	Analytical Services Table Analytical and Data Management SOPs	**Excluded**
C. Assessment Oversight		
31	Planned Project Assessments Table Audit Checklists	**Included**
32	Change Control Management	**Included**
33	QC Management Reports Table	**Included**
D. Data Review		
34	Verification (Tier I) Process Table – Preparatory and Initial Inspections	**Included**
35	Tier 2 Process Summary Table	**Included**
36	Product QC Tier 3 Process Summary	**Included**
37	Usability Assessment – AOC Certification Checklist	**Included**

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WORKSHEET #3: DISTRIBUTION LIST

[List those entities who receive copies of the SAP, subsequent SAP revisions, addenda, and amendments]

SAP Recipient	Title	Organization	Telephone Number	E-mail Address
Lance Higa	Project Manager	NAVFAC Pacific	808-471-9216	Lance.higa@navy.mil
Randall Hu	Environmental Engineer	Marine Corps Base HI	808-257-6920 ext. 81	Randall.hu@usmc.mil
Steven Mow	Remedial Project Manager	HDOH	808-586-4251	Steven.mow@doh.hawaii.gov
George Spencer	Program Manager	USAE	813-343-6368	gspencer@usatampa.com
Robert Nore	Project Manager	USAE	256-684-9791	bnore@usatampa.com
Al Crandall	Geophysicist	USAE	813-343-6362	acrandall@usatampa.com
Thomas Bernitt	Project Quality Control Manager	USAE	813-343-6414	tbernitt@usatampa.com
James Walden	Safety Manager	USAE	813-343-6374	jwalden@usatampa.com

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WORKSHEET #4: PROJECT PERSONNEL SIGN-OFF SHEET

Project Personnel	Organization/Title/Role	Telephone Number (optional)	Signature/email receipt	SAP Section Reviewed	Date SAP Read
Robert Nore	Project Manager	256-684-9791	bnore@usatampa.com	All	
Thomas Bernitt	PQCM	813-343-6414	tbernitt@usatampa.com	All	
Al Crandall	Project Geophysicist	813-343-6362	acrandall@usatampa.com	All	
TBD	Site PM				
TBD	Senior UXO Supervisor (SUXOS)				
TBD	UXOQC				

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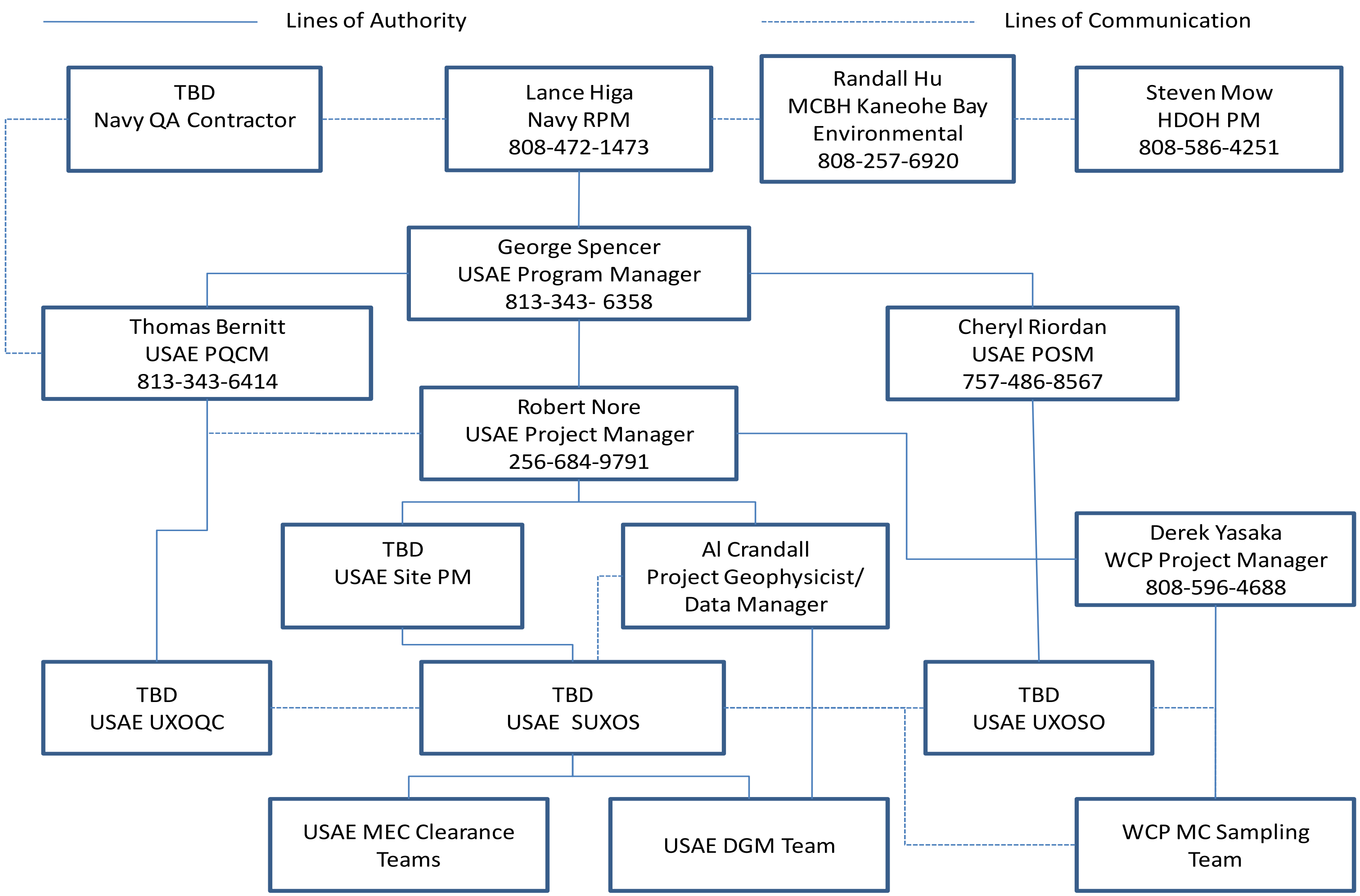
WORKSHEET #5: PROJECT ORGANIZATIONAL CHART



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WORKSHEET #6: COMMUNICATION PATHWAYS

Communication Drivers	Responsible Affiliation	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Overall implementation of the project	RPM	Lance Higa	808-471-9216	Primary point of contact for NAVFAC PAC, Navy lead for technical issues, and communication conduit to regulatory agencies
Technical issues during implementation of the project	Environmental Engineer, MCB Hawaii	Randall Hu	808-257-6920 ext. 81	Will be notified of significant technical issues by the Contractor through the RPM (verbal, written, or electronic)
QA issues during implementation of the project	QA Contractor	TBD		Will be notified of significant QA issues by the Contractor
Point of contact with NAVFAC PAC	Project Manager	Robert Nore	256-684-9791	All technical, QA, and administrative matters in regard to USAE's implementation of the project (verbal, written or electronic)
Minor change to MEC SAP	Project Manager	Robert Nore	256-684-9791	Will notify Site PM of approval of minor change (verbal, written or electronic); must sign official corrective action documentation (written only)
Major change to MEC SAP	Program Manager	George Spencer	(813) 343-6358	Will notify NAVFAC prior to implementation for review/approval; will notify Site PM of approval of major change (verbal, written or electronic); RPM and PM must sign official corrective action documentation (written only)
Deviation from MEC SAP	Site PM	TBD	(813) 343-6358	Will notify PM who in turn will contact RPM
Field program quality issues	PQCM	Thomas Bernitt	(619) 921-7224	Will notify the PM and/or Program QC/Safety Manager to determine corrective action (verbal, written or electronic)
Corrective action for field program issues	PQCM	Thomas Bernitt	(619) 921-7224	Will respond to a field program issue with potential corrective action (verbal, written or electronic)

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WORKSHEET #7: PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS TABLE

Name	Title/Role	Organizational Affiliation	Responsibilities	Qualifications (as appropriate)
Lance Higa	RI/FS Project Manager	NAVFAC PAC	• Perform project management for the Navy • Ensure that the project scope of work requirements are fulfilled • Oversee the project cost and schedule • Provide direction to the contractor's project team, according to the Navy's contracting process • Act as lead interface with agencies • Review and approve this SAP • Provide technical and administrative oversight of the QA contractor's and USAE's surveillance audit activities • Coordinate training on matters pertaining to generation and maintenance of quality of data • Authorize the suspension of project execution if quality assurance requirements are not adequately followed •	NA
Lance Higa	Navy Technical Representative (NTR)	NAVFAC PAC	• Maintain Contracting Officer's Representative (COR) files • Monitor and document USAE performance • Inspect and accept or reject contract deliverables • Day-to-day administration of the project • Identify issues that may impact scope, schedule, or budget and refer them to the contracting officer	NAVFAC Contracting Officer's Authorized Representative/ NTR Training
TBD	Quality Assurance (QA) Contractor	ECC, Inc.	• Review with this SAP • Provide oversight of USAE's Quality Assurance Program • Provide technical and administrative oversight of	NA

Name	Title/Role	Organizational Affiliation	Responsibilities	Qualifications (as appropriate)
			USAE's surveillance audit activities	
Robert Nore	Project Manager	USAE	• Coordinate work activities of contractor's personnel and subcontractors, and ensure that all personnel adhere to the administrative and technical requirements of the project • Monitor and report the progress of work, and ensure that the project deliverables are completed on time and within project budget • Monitor the budget and schedule, and notify the client and the RPM of any changes that may require administration actions • Ensure adherence to the quality requirements of the contract, project scope of work, and the quality control (QC) Plans • Ensure that all work meets the requirements of the technical specifications and complies with applicable codes and regulations • Ensure that all work activities are conducted in a safe manner in accordance with the Site Safety and Health Plan • Serve as the primary contact between NAVFAC PAC and the contractor for actions and information related to the work and include appropriate technical personnel in the decision-making • Coordinate satisfactory resolution and completion of evaluation and acceptance report for Deficiency Notices/Non-Conformance Reports • Submit the contractor's field sampling SOPs to NAVFAC PAC for approval	Contract required training and experience
Thomas Bernitt	Program QC Manager	USAE	• Establish and maintain the Quality Program • Oversee program QC for the remedial investigation • Work directly with the contractor and NAVFAC PAC	American Society for Quality Certified Manager of Quality/Organizational Excellence

Name	Title/Role	Organizational Affiliation	Responsibilities	Qualifications (as appropriate)
			to ensure implementation of the Program QC Plans • Act as a focal point for coordination for quality matters across all aspects of this project and resolve quality issues • Suspend project activities if quality standards are not maintained • Interface with NAVFAC PAC on quality-related items • Perform reviews of surveillance reports conducted by others • Provide and maintain an effective QC system for all project tasks • Function as a liaison with NAVFAC PAC's and subcontractors' quality personnel.	
TBD	Site PM	USAE	• Manage/Supervise field activities on a daily basis • Make project notifications, as required. • Initiate Field Change Requests as needed • Attend weekly QC meetings • Maintain project files • Interface between field team, subcontractors, and on-site Navy personnel • Prepare and submit the weekly status reportSign and forward to the PM documents that certify that all work has been performed in accordance with the SOW.	Contract required training and experience
TBD	SUXOS	USAE	• Accountable for all UXO handling activities • Chain of command oversight of field crews and subcontractors • Implementation of project plans and SOPs • Specific duties as outlined in the project plans and SOPs	Qualified IAW DDESB TP-18.

Name	Title/Role	Organizational Affiliation	Responsibilities	Qualifications (as appropriate)
Al Crandall	Project Geophysicist	USAE	• Recommend experienced personnel and maintain the geophysical staff throughout the project. • Coordinate field teams and support personnel to ensure consistency of performance and adherence to established schedules. • Provide technical leadership in the disciplines of geophysics, statistics, and in QC of the geophysical data. • Establish a list of equipment, computers, materials, and supplies necessary to perform the task. • Coordinate subcontractors for field geophysical activities. • Monitor technical performance of team members and subcontractors. • Perform technical reviews of all deliverables. • Approve contributions to any technical deliverable for any work element. • Communicate with NAVFAC PAC in areas of technical expertise.	
TBD	UXOSO	USAE	• Oversee all aspects of explosive safety on this project • Document site conditions and photograph UXO recovery and disposal operations • Ensure that all fieldwork is conducted IAW the Work Plan and APP • Provide safety direction to field staff and subcontractors • Implement the occupational safety program • Perform reviews, inspections, and surveillances of USAE's (and its subcontractors') task order activities to ensure that task order procedures are being followed	Qualified IAW DDESB TP-18.

Name	Title/Role	Organizational Affiliation	Responsibilities	Qualifications (as appropriate)
			•	
TBD	UXO Quality Control Specialist (UXOQCS)	USAE	• Conduct all QC procedures on site. • Seed grids and account for and track seed recovery • Audit all logbooks and documents generated during the 2010 Field Season pertaining to WVIA. • Monitor QC activities to ensure conformance with authorized policies, procedures, and sound construction practices, and recommend improvements, as necessary • Conduct site meetings covering the requirements of the construction QC procedures, as appropriate • Inform, identify, and resolve non-conformances in accordance with the requirements of the construction QC procedure • Stop work or require re-performance of any nonconforming activity resulting from improper application of prescribed procedures • Maintain awareness of the entire task order to detect conditions that may be adverse to quality • Monitor corrective action documentation for conditions adverse to quality, verify implementation of corrective actions • Ensure that data provided by the Site Geophysicist is accurate and comprehensive. • Verify that corrective actions have been implemented properly • Track and evaluate corrective action • Close out corrective action documentation upon completion • Concur with Deficiency Notice (DN) and Nonconforming Report (NCR) dispositions, and maintain DN/NCR tracking and analysis system	Qualified IAW DDESB TP-18.

Name	Title/Role	Organizational Affiliation	Responsibilities	Qualifications (as appropriate)
			• Function as a liaison with NAVFAC PAC's and subcontractors' quality personnel. • Compile the Certification Package.	
TBD	UXO Technicians III, II, & I	USAE	• Adequately review the Work Plan and understand all SOPs and guidance applicable to their tasking for the project • Surface clearance of MEC • Intrusive investigations for MEC • Anomaly avoidance activities	UXO Technicians will be qualified IAW DDESB TP-18.
TBD	Site Geophysicist	USAE	• Support the Project Geophysicist in training the digital geophysical mapping (DGM) Team • Manage DGM Field Operations • Process and Analyze DGM data • Report results to Site PM, UXOQCS, and Project Geophysicist • Submit field information data for upload into the Navy's database • Check electronic data for completeness (e.g., all required fields are entered) • Submit formatted data to the Navy in accordance with the requirements set forth in NAVFAC PAC's *Standard Operating Procedure (SOP) for Navy Environmental Information Transfer, Version 3.1* (or subsequent updates) • Adequately review and understand all SOPs and guidance applicable to their tasking for the project	Bachelor's degree in an Engineering field and 5 years experience in performing geophysics tasks.
TBD	Geophysical Field Team Leader	USAE	• Schedule daily field crew activities in concert with the Site Geophysicist • Maintain data acquisition–related paperwork and ensure its accuracy • Supervise geophysical field operations and related	May be UXO Technician

Name	Title/Role	Organizational Affiliation	Responsibilities	Qualifications (as appropriate)
			surveying activities, including directing field team activities • Log all activities at the geophysical survey site in the field logbook or personal digital assistant and maintain relevant files • Ensure that all materials needed at the survey site are in stock (geophysical equipment, writing materials, tape, diskettes, markers, etc.) • Check sites to be surveyed and access routes in advance of data acquisition activities • Report the level of effort expended to the Site Geophysicist on a daily basis • Download data at the processing center on a daily basis • Perform daily repeatability checks for geophysical instrumentation • Use creative thinking to improve the efficiency and/or quality of the data based on site-specific survey conditions	
TBD	Geophysical Instrument Operator	USAE	• Properly set up, operate, and maintain the EM61-MK2 • Properly acquire daily instrument checks and production DGM data • Properly download data files and submit to the Site Geophysicist • Record all DGM activities in the daily log book or survey forms.	May be UXO Technician

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WORKSHEET #8: SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE

All project personnel will meet the qualification and specific training requirements identified in this table prior to being assigned to the project.

Project Function By DFW	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Mobilization/Site Preparation	Initial Site Orientation and Plans Review	SUXOS, UXOSO	Upon arrival to project site	All personnel	USAE	Documentation of special training requirements will be maintained on-site by USAE
	29 CFR 1910.120 Training	Vendor	Prior to mobilizing to project site			
	ITS Certification	Site Geophysicist	Training will be conducted prior to commencement of field activities	UXO Teams		
	Use of DGPS equipment			Geophysical Survey Teams, UXO Teams, UXOQCS		
Surface Clearance	MEC Safety Precautions and Task Specific SOPs	SUXOS, UXOSO		All personnel entering exclusion zone		
Intrusive Operations						
MEC/MPPEH Management and Disposal				UXO Qualified Team Members		
Geophysical Survey	Digital Geophysical Survey SOP 2	Project and Site Geophysicist		Geophysical Survey Team, Geophysical QC Manager, QC Technicians		
Geophysical Data Processing & Interpretation	Geophysical Data Processing & Interpretation SOP 3					

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WORKSHEET #9: PROJECT SCOPING SESSION PARTICIPANTS SHEETS

Site Name/Project Name: Remedial Investigation/Feasibility Study
Operable Unit: Waikane Valley Impact Area
Scoping Session Purpose: To come to agreement with specific scoping and objective boundaries for the project.

Site Location: Kaneohe, Hawaii
Work Assignment Number: NA
Date of Session No. 1: May 5, 2009

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Richard Hosokawa	Program Manager	NAVFAC Pacific	808-472-1423	Richard.hosokawa@navy.mil	NAVFAC PAC MRC Program Manager
Wray Kakugawa	Remedial Project Manager	NAVFAC Pacific	808-472-1421	Wray.kakugawa@navy.mil	Navy RPM
Rob Sadorra	MRP Tiger Team	NAVFAC HQ	202-685-9306	Robert.sadorra@navy.mil	NAVFAC PAC Advisor
Bryan Harre	MRP Tiger Team	NAVFAC ESC	805-982-1795	Bryan.harre@navy.mil	NAVFAC PAC Advisor
Robert Kratzke	MRP Tiger Team	NAVFAC ESC	805-982-4853	Robert.kratzke@navy.mil	NAVFAC PAC Advisor
Mike Green	MRP Tiger Team	NAVFAC LANT	757-322-8108	Mike.green@navy.mil	NAVFAC PAC Advisor
Mark Murphy	MRP Tiger Team	NAVFAC PAC	360-396-0070	Mark.s.murphy1@navy.mil	NAVFAC PAC Advisor
Mark Wicklein	MRP Tiger Team	NAVFAC PAC	360-396-0226	mark.wicklein@navy.mil	NAVFAC PAC Advisor
Patricia McFadden	MRP Tiger Team	BRAC	415-743-4720	Patricia.a.mcfadden@navy.mil	NAVFAC PAC Advisor
George Spencer	Program Manager	USAE	813-343-6368	gspencer@usatampa.com	Program Manager
Robert Nore	Project Manager	USAE	256-684-9791	bnore@usatampa.com	Project Manager
Robert Crownover	Quality Manager	USAE	813-343-6364	rcrownover@usatampa.com	Corporate QC
James Walden	Safety Manager	USAE	813-343-6374	jwalden@usatampa.com	Corporate Safety

Comments/Decisions: USAE will prepare RI Work Plan for WVIA.

Action Items: RI Work Plan for WVIA and ancillary documents.

Consensus Decisions: Problem statements for MEC SAP Worksheets were agreed to.

Site Name/Project Name: Remedial Investigation/Feasibility Study
Operable Unit: Waikane Valley Impact Area
Scoping Session Purpose: To review anticipated land use map and discuss revised objectives and boundaries.

Site Location: Kaneohe, Hawaii
Work Assignment Number: NA
Date of Session No. 2: May 21, 2009

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Richard Hosokawa	Program Manager	NAVFAC Pacific	808-472-1423	Richard.hosokawa@navy.mil	NAVFAC PAC MRC Program Manager
Randall Hu	Environmental Engineer	Marine Corps Base HI	808-257-6920 ext. 81	Randall.hu@usmc.mil	Installation POC
Richard Hosokawa	Remedial Project Manager	NAVFAC Pacific	808-472-1423	Richard.hosokawa@navy.mil	Navy RPM
Kris Saboda	QA Manager	NAVFAC Pacific	808-472-1409	kristine.saboda@navy.mil	QA Manager
Bryan Harre	MRP Tiger Team	NAVFAC ESC	805-982-1795	Bryan.harre@navy.mil	NAVFAC PAC Advisor
Robert Kratzke	MRP Tiger Team	NAVFAC ESC	805-982-4853	Robert.kratzke@navy.mil	NAVFAC PAC Advisor
Mike Green	MRP Tiger Team	NAVFAC LANT	757-322-8108	Mike.green@navy.mil	NAVFAC PAC Advisor
Mark Murphy	MRP Tiger Team	NAVFAC PAC	360-396-0070	Mark.s.murphy1@navy.mil	NAVFAC PAC Advisor
Mark Wicklein	MRP Tiger Team	NAVFAC PAC	360-396-0226	mark.wicklein@navy.mil	NAVFAC PAC Advisor
Patricia McFadden	MRP Tiger Team	BRAC	415-743-4720	Patricia.a.mcfadden@navy.mil	NAVFAC PAC Advisor
George Spencer	Program Manager	USAE	813-343-6368	gspencer@usatampa.com	Program Manager
Robert Nore	Project Manager	USAE	256-684-9791	bnore@usatampa.com	Project Manager
Robert Crownover	Quality Manager	USAE	813-343-6364	rcrownover@usatampa.com	Corporate QC
James Walden	Safety Manager	USAE	813-343-6374	jwalden@usatampa.com	Corporate Safety

Comments/Decisions: NAVFAC PAC will discuss Land Use CSM with Hawaii DOH.

Action Items: USAE continue with Worksheets 9, 10, 11, 14, and 17, Tiger Team provide additional comments.

Consensus Decisions: No Digital Geophysical Mapping except for after completion of subsurface investigation

Site Name/Project Name: Remedial Investigation/Feasibility Study
Operable Unit: Waikane Valley Impact Area
Scoping Session Purpose: To review anticipated land use map and discuss revised objectives and boundaries.

Site Location: Kaneohe, Hawaii
Work Assignment Number: NA
Date of Session No. 3: June 5, 2009

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Richard Hosokawa	Program Manager	NAVFAC Pacific	808-472-1423	Richard.hosokawa@navy.mil	NAVFAC PAC MRC Program Manager
Randall Hu	Environmental Engineer	Marine Corps Base HI	808-257-6920 ext. 81	Randall.hu@usmc.mil	Installation POC
Richard Hosokawa	Remedial Project Manager	NAVFAC Pacific	808-472-1423	Richard.hosokawa@navy.mil	Navy RPM
Steven Mow	Remedial Project Manager	DOH-HEER Office	808-586-4251	Steven.mow@doh.hawaii.gov	Regulatory oversight
Maria Reyes	Remedial Project Manager	DOH-HEER Office	808-586-7576	Maria.reyes@doh.hawaii.gov	Regulatory Oversight
George Spencer	Program Manager	USAE	813-343-6368	gspencer@usatampa.com	Program Manager
Robert Nore	Project Manager	USAE	256-684-9791	bnore@usatampa.com	Project Manager
Al Crandall	Geophysicist	USAE	813-343-6362	acrandall@usatampa.com	Project Geophysicist
Thomas Bernitt	Program Quality Control Manager (PQCM)	USAE	813-343-6414	tbernitt@usatampa.com	PQCM
James Walden	Safety Manager	USAE	813-343-6374	jwalden@usatampa.com	Corporate Safety

Comments/Decisions: NAVFAC PAC discussed proposed Land Use CSM with attorneys.

Action Items: USAE continue with Worksheets 9, 10, 11, 14, and 17, and rest of MEC SAP worksheets

Consensus Decisions: Add transect 5' wide across southern end of 3 targets to be investigated subsurface.

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WORKSHEET #10: PROBLEM DEFINITION

WAIKANE VALLEY IMPACT AREA DATA QUALITY OBJECTIVES

Step 1. Problem Statement:

The Site Inspection has determined that past operation of the former impact area has resulted in explosive safety hazards concentrated in four specific areas of the site.

Prior to its acquisition by the U.S. Government during World War II, the 187-acre Waikane Valley Impact Area (WVIA) was privately owned, contained a residence, and was used for agriculture on the lower elevations. Upon acquisition, the land became part of a 2,000 acre lease known as Waiahole Training Area, which was used for jungle training and field maneuvers. The 187-acre area was subjected to ordnance sweeps by the US Marine Corps in 1976 and 1984. Over 40,000 pounds of munitions debris was removed from the site along with over 700 unexploded ordnance (UXO) items during the two ordnance sweeps. The after action reports both concluded that the property could never be certified clear of ordnance.

The government acquired title to the hazardous area, and installed a perimeter chain-link fence in 1992. The site is managed as an “other than operational range”, with access controlled by Marine Corps Base Hawaii such that civilians may only enter the property when accompanied by Explosive Ordnance Disposal (EOD) personnel.

A Site Inspection of WVIA conducted in October 2008 resulted in the identification of 70 UXO items and four target areas of concern (AOC). The westernmost AOC contains small arms munitions, and the other three AOCs contain practice and high-explosive 3.5-inch rockets, 2.36-inch rockets, and shoulder-fired rifle grenades. The desired future use for the 187-acre former impact area is eventual transfer to public or private ownership.

It is necessary to establish the desired future land use for all areas of the site in order to determine possible remedial actions that are suitable for the desired future land use. It is also necessary to determine the nature and extent of MEC items that may be present at the site in order to analyze the explosive hazard presented by the site for current and future users. Based on the assessment of the explosive safety hazard posed by the site, the need for remediation of the sites or areas within the site will be determined based on land use. Alternatives will be evaluated to determine the most effective hazard reduction approach for the RI/FS. Portions of the property that cannot be cleared may be retained by the US Marine Corps, or else Land Use Controls may be instituted. A detailed site history and description are included in the Work Plan.

EXPOSURE CONCEPTUAL SITE MODEL

The graphic Conceptual Site Model (CSM) at Figure A-4 and the pictorial CSM at Figure A-5 explain the site and its environmental settings and presents information regarding MEC contaminant sources, migration pathways, and receptor exposure pathways potentially present at WVIA.

Source Area and Source Media

The SI confirmed presence of small arms, rifle grenades, and 2.36-inch and 3.5-inch rockets as source media at WVIA. In addition, evidence gathered during the reconnaissance survey indicates that 4 distinct target areas were used within the MRS. These target areas are identified as AOCs 1 through 4 and are shown on Figure A-2. Mortars and projectiles were not fired at these targets, although a 75 mm base plate and a mortar fuze were found. These two items were apparently kick-outs from detonations at other targets on the adjacent FUDS property.

Release Profile, Exposure Media, and Exposure Routes

The release profile for the potential MEC contamination at or below the ground surface is identified to be MEC transported through human activities, surface water run-off, or soil erosion. The potential exposure media would include surface soil, subsurface soil, and inland surface water sediments. Transport pathways leading to potential exposure to on-site receptors tend to result in reduced MEC exposure at receptor points distant from the site. The target areas identified during the SI are located in steep, unstable areas subject to erosion. The exposure route for MEC hazards is exclusively direct contact.

Receptors

The CSM evaluates three potential human receptor groups: (1) future onsite residents and construction workers, (2) current and future offsite residents, and (3) current and future recreational users and trespassers. There are currently no onsite residents. The ecological receptor CSM evaluates two potential receptor groups: (1) terrestrial wildlife, and (2) aquatic wildlife.

Pathway Analysis

Analysis of the profile information allowed USAE to identify source-receptor interactions (exposure pathways) for the MRS. For MEC, exposure pathways at WVIA include source, access, activity and receptor. For the source area (targets), the MEC contaminants are mortars, rockets, grenades, and small arms. MEC exists on the surface and subsurface. If disturbed or handled inappropriately, the MEC items could pose a serious explosive hazard. Interaction for the MEC component of this CSM requires an exposure route (access) and exposure media. Current access to the source area is somewhat restricted by heavy vegetation, rough terrain, and a chain-link fence, but there is ample evidence that humans access the source area. Activities, which can bring receptors into contact with potential MEC are boar hunting, all-terrain vehicle riding, recreational use, and potential future residential or construction activities. All on-site receptors have the potential for exposure. Excavation conducted by future onsite residents, construction workers, and recreational users (or trespassers) may result in direct contact with exposure to MEC. Serious erosion of the target areas has occurred in the past and further erosion is anticipated in the future, but such erosion would not be sufficient to transport MEC off site. The exposure pathway to off-site receptors is incomplete because of the attenuating effect of distance from the site. Onsite ecological receptors may be exposed to MEC lying on the surface or in the root zone. Terrestrial animals are subject to exposure to MEC hazards, either by traveling across the surface or burrowing.

Step 2. Identify Decisions to be Made:

This project must:

- Determine the desired future land use for all areas of the site.
- Determine the appropriate investigation and cleanup criteria to support the desired future land uses.
- Determine if existing information is sufficient to support evaluation of cleanup alternatives which support desired future land uses.
- Determine the nature and extent of the explosive hazard (hazard assessment) to current and future users.

Step 3. Identify Information Inputs:

Earlier studies have concluded that MEC are present within the AOC boundaries and that additional remedial actions are necessary. Information necessary to allow decision makers to address the decisions identified in Step 2 include:

- Existing data from previous investigations.
- Additional surface data to establish the horizontal extent of AOCs
- Intrusive data to establish the density and vertical extent of MEC within the AOCs.
- Conceptual Site Model with desired future land uses defined.
- Cleanup/clearance requirements applicable to each potential land use to be evaluated.
- Limitations to data gathering such as topography, vegetation, historic preservation issues, and detection technology.
- MEC Hazard Assessment (MEC HA) data necessary to support evaluation of each site.

- Production data to support cost estimates for future remediation efforts, including an assessment of the feasibility of Digital Geophysical Mapping (DGM).

Step 4. Define the Boundaries of the Study:

The horizontal boundaries for the RI/FS includes the entire 187-acre site (see Figure A-1). Horizontal boundaries for the MEC surface clearance are the four AOCs enclosing the targets (Figure A-2) and identified during the SI. The MEC investigation boundaries are approximate and will be verified during the surface clearance by step-out procedures explained in Step 5. Horizontal boundaries for subsurface investigations will be 50-foot by 50-foot grids (or equivalent area as dictated by field conditions) established in the field based on surface clearance data, 8 grids to each target: 2 center grids located at the most contaminated portion of the target and the remaining 6 grids spaced outward from the center grids, within but near the edge of the contaminated portion of the target. A transect 3 feet wide and stretching across the southern end of AOCs 2, 3, and 4 will be subsurface investigated up to a depth of 4 feet, depending on depth to bedrock.

LAND USE CSM

A Land Use CSM for proposed future land use (Figure A-3) shows three proposed land uses within the 187-acre site. Land use categories are based on accessibility and on historic use. . The Potential Recreation area (shown in red) reflects the steepest terrain, which could not be accessed (except for 3 reconnaissance paths which led to the top elevations) by the SI team. Figure A-6 indicates the paths taken by the reconnaissance team. The Potential Recreation area generally includes all land above the 400-foot elevation, approximately 85 acres.

The Recreational area (shown in yellow) is accessible, but is not usable for and has not been used for residential development or agricultural purposes due to extreme terrain. The Recreational area, approximately 62 acres, includes all land between the 300-foot and 400-foot contours and a small area in the middle of the site which extends to the 500-foot elevation.

The Residential area (shown in green) consists of approximately 40 acres below the 300-foot contour along Waikane Stream. The residential area is suitable for construction of residences or for agricultural purposes, and was used by the previous owner for residences and light agriculture.

A 30^0 slope is generally accepted as the steepest slope at which personnel may work without special safety lines. Detection equipment at this point also becomes very difficult to use and therefore unreliable. The blue 30^0 line shown on the land use CSM illustrates the approximate limits of safe access and equipment usability. The line is a computer-generated average of the terrain across the entire site, and is therefore only an approximation. RI activities will be in general limited to slopes of 30 degrees or less.

Vertical extent of MEC investigations extend from the surface to the maximum depth of detection of the geophysical instruments or to a depth of 2 feet in areas suitable for recreation. Excavations will extend to the maximum depth of detection or to a depth of 4 feet in areas identified as suitable for residential development. Excavations will cease when bedrock is reached, regardless of depth. Characterizing conditions to these depths will provide the information needed to evaluate options in these areas during the Feasibility Study (FS) with respect to potential activities associated with the desired future land use and potential MEC migration processes (i.e., erosion).

Step 5. Develop the Approach (Decision Rules):

This information is the basis for assessing explosive hazard, determining the need for additional evaluation or remedial action, obtaining data to evaluate remedial action alternatives, and selecting a remedy.

- Vegetation will be cleared to within 6 inches of ground surface.
- Analog detection and will be used for detection of surface MEC.

- If, during surface clearance, MEC is still being discovered at the boundary of an AOC, surface clearance will continue until no additional MEC has been found for 50 feet in any direction.
- Analog detection, along N/S lanes, will be used for subsurface investigation. DGM will be used to produce a map of remaining anomalies within the areas of subsurface investigation.
- Locations of MEC items discovered during the week will be recorded, and the items will be destroyed by demolition at the end of each workweek.
- Safety standards require that UXO be blown in place. A MEC item will only be moved if the SUXOS and UXOSO determine that the item is acceptable to move.
- If an item that cannot be moved is located near an archaeological feature, the project team archaeologists will refer to the Archaeological Monitoring Plan for a determination on how best to protect the features.
- All past and present data will be processed through the MEC HA to score sites in order to determine whether they should receive no further action or be further evaluated in a feasibility study.

Step 6. Specify Performance or Acceptance Criteria:

Completion of RI sampling in accordance with this work plan or adjusted process agreed to (in advance) by the Project Team.

Analog and Digital Metal detectors must be capable of locating anomalies to the depths defined by the Instrument Test Plot (ITS) process and presented in a ITS report.

Metal detectors and positioning equipment must be functional in steep, rugged terrain (i.e., in all areas considered accessible) and must remain operational in inclement weather (including periods of heavy rainfall). Other factors used to evaluate equipment performance may include the relative influence of magnetic geological features on the equipment performance, ease of operation, and the use of blind seeds. See Worksheet 12.

A Professional Land Surveyor will survey in the AOC boundary and establish grid corners to an accuracy of 0.1 foot. Survey instrumentation used for DGM surveying will be accurate to within 1.5 feet, using traditional line, station, fiducial, positioning with fiducials every 25 feet. Boundaries of areas where surface clearance has been completed will be surveyed to an accuracy of 3.0 feet.

Data collection must support application of the MEC HA in accordance with the project-specific documentation developed for WVIA.

Step 7. Develop the Plan for Obtaining Data

A summary of the definable features of the work are presented in WS #14. WS #17 provides the rationale for data collection and the detailed description of how data will be obtained, processed, and interpreted.

WORKSHEET #11: PROJECT QUALITY OBJECTIVES/SYSTEMATIC PLANNING PROCESS STATEMENTS

WHO WILL USE THE DATA?

NAVFAC Pacific and regulators; USAE will also use the data to prepare the RI/FS Report.

WHAT WILL THE DATA BE USED FOR?

The data will be used to prepare the RI/FS report which will document the findings of the data collection efforts and field inspection. This data, along with data previously gathered, will be used to assess the nature and extent of the hazard presented by MEC at the WVIA site in order to support recommendations for proposed MEC remedies. The data will be used to develop a hazard analysis by evaluating and vertically delineating the nature and extent of potential hazards to human health and the environment. In addition, the data will be used to determine if the contamination extends beyond the AOCs. The findings of this RI/FS will also augment the data collected in the PA and SI and will provide a basis for determining whether the site (or portions of the site) can be NOFA or needs to move forward to the Feasibility Study for analysis of further response actions.

WHAT TYPE OF DATA IS NEEDED?

- Surface MEC clearance data to document quantities and types of MEC within target areas.
- Analog ITS Certification data.
- MEC intrusive investigation data to document the MEC subsurface investigation.
- Digital Geophysical Mapping and data interpretation to verify the subsurface investigation effectiveness and to prove out the effectiveness of geophysical equipment.
- Data concerning the reasonably desired future land use.
- Data required to determine whether the residual hazard from a remedial action is acceptable with respect to the desired future land use.
- QC documentation.

HOW “GOOD” DO THE DATA NEED TO BE IN ORDER TO SUPPORT THE ENVIRONMENTAL DECISION?

The quality of data collected during this RI/FS must be able to support the MEC HA which will be used to develop recommendations for further action at WVIA. Sufficient definitive data with adequate quality control (QC) are needed to determine if hazard-based criteria have been exceeded in each AOC as defined in the Data Quality Objective (DQO) process. Data quality will be judged based upon compliance with performance criteria for geophysical detection and intrusive operations as specified in Worksheet #12, 34, 35, and 36.

HOW MUCH DATA ARE NEEDED?

The amount of data needed is determined by the Project Team and the previous Site Inspection (SI). Data from the SI is sufficient to determine the hazard in areas surrounding the AOCs. A complete surface clearance within the four AOCs will provide adequate information to assess the horizontal extent of hazard. Subsurface sampling of 100 percent of anomalies over a total of 2 acres within the AOCs will provide adequate information to assess the vertical extent of hazard. Subsurface sampling of a 5-foot wide transect extending across the southern end of AOC’s 2, 3, and 4 will reveal whether MEC has been transported by erosion to downslope areas. The surface clearance and subsurface investigation together will provide sufficient information to determine the nature of the hazard. These data requirements were established in order to ensure that AOCs would be characterized during investigation with a high level of confidence. This methodology was also designed to provide sufficient data for the planned hazard screening. The methodology is discussed in Section 3.0 of the RI Work Plan (WP). The hazard methodology is discussed in Section 4.0 of the WP. The location, depth, orientation, type, nomenclature, and status of each item will be recorded in the project database.

WHERE, WHEN, AND HOW SHOULD THE DATA BE COLLECTED/GENERATED?

The data will be collected from the AOCs shown in Figure A-2 and as defined in Section 3.0 of the WP. The schedule is included in Section 6.0 of the WP. The data will be collected in accordance with the SOPs identified in Worksheet #21.

WHO WILL COLLECT AND GENERATE THE DATA?

Prime contractor USAE will conduct all aspects of the geophysical investigation and MEC removal, using personnel qualified and trained in accordance with the provisions of this SAP and the WP. Subcontractor CH2M Hill will analyze the field data and develop the preliminary draft RI Report. The Navy will perform any required QA. Additional information on project personnel is provided in Worksheets #5, #6, and #7.

HOW WILL THE DATA BE REPORTED?

Field data will be presented in several different formats selected to meet the objectives of the RI. These include:

- Analog System Certifications
- Analog Surface Clearance reports and maps
- Analog Subsurface AOC characterization Reports and maps for investigation grids and transect
- DGM maps and anomaly lists for post intrusive characterization of investigation grids and transect

Data from surface clearance and intrusive operations will be captured either electronically into a data collector, or on paper and transferred into the project GIS database. Dig results, photographs of MEC encountered, MEC destruction information, and shipment records for material documented as safe (MDAS) will be captured.

Post intrusive DGM data will be reported in color-coded maps that display the sensor data over the surveyed areas, integrated into the project GIS database. The color scale will be sensitive enough to show the smallest anomaly of interest. Another format will be DGM anomaly lists, which will be either MS Excel or MS Access format that will provide information on each anomaly identified in each DGM survey area. The anomaly list data for each grid or transect will be organized by a unique grid or transect identifier, and contain a unique anomaly identifier for each target selection, its x-y coordinate location, and all anomaly selection values (e.g. Grid Value, and may include Signal to Noise Ration, Signal Strength, and Size) from the EM61-MK2 processed data. The raw geophysical data, which will be in an ASCII text format in digital files on CD or DVD is also provided. This file will contain, at a minimum, relative and/or state plane coordinates of each measurement location (x, y, and z), EM61 MK2 signal intensity for each time gate, and a time stamp for each measurement. A summary of the data will be included in the RI report.

HOW WILL THE DATA BE ARCHIVED?

Generated hardcopy data (field- and/or laboratory-related) will be stored in the project files after undergoing processing/review. Project data will be transferred into the Navy Electronic Data Deliverables/Navy Installation Restoration Information System. The hardcopy data will then be submitted to the National Archive and Records Administration for 50-year storage.

WORKSHEET #12: MEASUREMENT PERFORMANCE CRITERIA

Definable Feature of Work _ _ _ _ _ **Data Type**	**Geophysical Anomaly Measurement Data Quality Indicator**	**QC Sample and/or Activity to Assess Measurement Performance**	**Measurement Performance Criteria**	**Frequency**
DFW: Site Prep/Grid Layout _ _ _ _ _ Positional Data	Accuracy	QC audit of positioning system error test records	Survey monuments, grid corners, and transect points installed by professional land surveyor (PLS). Grid corners are internally consistent within 30 cm on any leg or diagonal.	After PLS survey
DFW: Surface Clearance _ _ _ _ _ Analog Detector	Response	Function check: Instrument checks to determine response of analog detector to metallic objects in the ITS	Positive response to presence of any MEC item on the surface. The test will be conducted with a small metal object	Daily
	Completeness	QC audit of MEC accountability	100 percent of MEC items logged during the week are verified as BIP or otherwise disposed of	Weekly
DFW: Intrusive Operations _ _ _ _ _ Anomaly Resolution Data	Accuracy	QC to sample identification of munitions-related anomaly sources	Type, condition, and fuzing state (no fuze, unarmed fuze, armed fuze) of munitions-related items correctly identified	Each Occurrence
	Accuracy	QC review of identification of blind seed item (BSI) location	100 percent of all BSIs installed by the UXOQCS will be removed and their location and depth accurately located to be within 1 foot.	At completion of grid
	Completeness	QC audit of anomaly identification data; QC of excavation following to ensure removal of targets to specific depth	Every target anomaly less than or equal to 4 feet below ground surface (bgs) (has been resolved (anomalies below the specified limits will not be resolved).	At completion of grid
	Completeness	QC audit of anomaly identification forms (Daily Grid Tracking Logs – electronic)	Anomaly identification forms (electronic) completely and correctly filled out for each anomaly	Daily
	Completeness	QC audit of MEC accountability	100 percent of MEC items logged during the week are verified as BIP or otherwise disposed of	Weekly
DFW: Geophysical Survey _ _ _ _ _	Precision	Standardization tests: QC audit of response test records	Response above background to standard object will not vary more than ±20% for the instrument used (Geonics EM61-MK2	Daily

Raw Geophysical Sensor Data			or approved equivalent)	
	Completeness	Site survey coverage: Data capture ability assessed during Instrument Test Strip (ITS); Instrument checks serve as QC to calculate completeness during field activities	The allowable variance for investigation will not exceed 2% of the accessible area surveyed. If the total area of the gaps exceeds this percentage, data will be recollected in those gaps if possible.	Daily
	Sensitivity	Data density: Assessed during ITS; Instrument checks serve as QC to calculate data density during field activities	95% of each production DGM dataset has a minimum data density of one point per 0.15 m (0.5 ft)	Daily
	Precision	Noise Error: Referenced amplitude to be determined during ITS; standard deviation of background noise in instrument checks to be calculated and assessed during field activities	Maximum standard deviation of noise not to exceed 20% of the amplitude for the signal for a horizontal 3.5" rocket at 1.5 ft bgs	Daily
DFW: Geophysical Data Processing & Interpretation _ _ _ _ _ Prioritized Anomaly Detection List	Representativeness	Probability of detection (Pd) assessed	Survey to achieve 100% detection for all anomalies at their typical maximum detection depth (e.g. 11 times diameter) or as demonstrated at the ITS.	During ITS and Daily
	Sensitivity	Maximum detection depth assessed	Sensor to identify anomalies at their typical maximum detection depth (e.g. 11 times diameter) or as demonstrated at the ITS.	During ITS and Daily
	Selectivity	Percent false positive assessed during ITS; daily instrument checks serve as QC to calculate false positive rates during field activities	Percent false positives (pfp) not to exceed 15% of all identified anomalies	During ITS and Daily
DFW: Geophysical Data Processing & Interpretation _ _ _ _ _ Processed Geophysical Sensor Data	Comparability	Signal-to-noise ratio (SNR) calculated and assessed during instrument checks	Minimum SNR to vary no more than 5% from the SNR for the raw data, assuming the site conditions remain constant	Daily
DFW: Geophysical Data Processing & Interpretation _ _ _ _ _ Merged Positional and Geophysical Data	Accuracy	Accuracy of interpreted anomaly locations assessed during ITS and instrument checks	Interpreted locations of anomalies within 1-m radius of actual location	Daily
	Accuracy	QC audit of "latency" test records	Total positional error of merged data set will not exceed 0.3 m	

WORKSHEET #13: SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data May Be Used (if deemed usable during data assessment stage)	Limitations on Data Use
Preliminary Range Assessment and Archives Search Report	*Preliminary Range Assessment Report and Archive Search Report for Waikane Valley Training Area. (USACE 1998)*	U.S. Army Corps of Engineers (USACE); archives and interview data;1998	Data may be used to develop DQOs for data collection to fill data gaps	Much of the interview data cannot be verified.
Inventory Project Report	*DERP-FUDS Inventory Project Report, Waikane Training Area, Island of Oahu, Hawaii, Site No. H09H1035400 (USACE 1996)*	U.S. Army Corps of Engineers; archives and interview data; 1996	Data may be used to develop DQOs for data collection to fill data gaps	Much of the interview data cannot be verified.
After Action Report	*After Action Report; Waikane Valley Training Area; 20 Sep 1976*	U.S. Marine Corps EOD; results of surface clearance	Data may be used to establish types of ordnance to be expected	Report indicates that terrain limits ability to completely clear property
After Action Report	*After Action Report of Ordnance Survey on the Kamaka Portion of the Waikane Valley Training Area; 6 Jan 1984*	U.S. Marine Corps EOD; results of surface clearance	Data may be used to establish types of ordnance to be expected	Report indicates that terrain limits ability to completely clear property

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WORKSHEET #14: SUMMARY OF PROJECT DEFINABLE FEATURES OF WORK

The implementation of the MEC investigation has been divided into definable features of the work (DFW), and the tasks required to complete each DFW have been identified. Procedures for these tasks, including recording data, forms and checklists, data generation, QC checks, data management, and information management, are defined in the SOPs for the project indexed in Worksheet #21.

PROJECT DFW AND TASKS

Definable Feature of Work	Tasks
Mobilization/Site Preparation	• Initial Orientation and Training • ITS Preparation • ITS Certification • Boundary and Grid Layout • Vegetation Removal •
Surface Clearance	• Surface Clearance of 4 AOCs and Transect
Intrusive Operations	• Excavation of Target • Identification/Classification of MPPEH/MEC • Transfer of MPPEH
MEC/MPPEH Management and Disposal	• MEC Accountability • MEC Disposal • Donor explosive handling • MEC Consolidation and Disposal • Munitions Debris Management
Site Restoration	• Backfill (as necessary) • Scrap Management
Geophysical Survey	• DGM ITS & Daily Instrument Checks • DGM Survey and Daily Instrument Checks • DGM data transfer/download
Geophysical Data Processing and Interpretation	• DGM Data Processing • DGM data reporting/upload

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WORKSHEET #15: REFERENCE LIMITS AND EVALUATION TABLE

Note: This worksheet pertains to chemical analysis and related activities, and not to MEC Site Inspection work.

Matrix:

Analytical Group:

Concentration Level:

Not Applicable

Analyte	CAS Number	Project Screening Criteria/Action Limit[1] (mg/kg)	Project QL [2] (mg/kg)	Analytical Method[3]		Achievable Laboratory Limits[4]	
				MDL	Method QL (mg/kg)	MDL	QL (mg/kg)

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WORKSHEET #16: PROJECT SCHEDULE/TIMELINE TABLE

The project schedule is located within the WP at Section 6.0.

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WORKSHEET #17: SAMPLING DESIGN AND RATIONALE

This section describes the project definable features of work and tasks that will be performed to meet the requirements and objectives. Based on the results of the October 2008 site inspection, five separate AOCs were identified within WVIA: the four target areas and Waikane Stream. The four target AOCs and a single transect below the target AOCs will be further investigated for MEC characterization purposes. All five AOCs are addressed for soil or sediment contamination issues in the MC SAP.

17.1 EXCLUSION ZONES

Exclusion zones (EZs) will be established at the AOCs while intrusive or disposal operations are being conducted. An EZ is a controlled area where only essential or authorized personnel are allowed while qualifying activities are taking place. Essential personnel are personnel whose duties require them to remain within the EZ to ensure that munitions operations are conducted in a safe and efficient manner. Authorized personnel include agency personnel and others conducting project-related functions that require them to be present in the EZ for a specific purpose for a limited time. Under certain conditions, and on a case-by-case basis, authorized visitors will be granted access to the EZ when operations are being conducted, provided that the following requirements are fulfilled:

- Access is limited to essential personnel and authorized personnel.
- The UXOSO has completed an operational risk assessment.
- The maximum number of persons allowed in the EZ at one time will be determined by the SUXOS and UXOSO. The ratio of UXO-qualified escorts to visitors will be determined by the SUXOS at the time of the visitation.
- Persons requesting access to the EZ must demonstrate a legitimate need for access and obtain authorization from the Navy, Contractor Project Manager, and UXOSO; they must also submit their access request well enough in advance for the UXOSO to schedule an escort.
- Visitors must receive a site-specific briefing explaining the hazards and safety procedures associated with the EZ and must acknowledge the receipt of the briefing in writing.
- Authorized visitors must be escorted by UXO-qualified personnel at all times.

Any authorized visitor who violates established safety procedures will be immediately escorted out of the EZ for the visitor's own protection and to protect essential personnel in the EZ.

These site-specific procedures addressing EZ access have been developed for this project in accordance with NOSSA Guidance (NOSSA 2006).

The size of the EZ is based on the hazardous (versus the maximum) fragment distance of the munition with the greatest fragment distance (MGFD) and forms the explosives safety quantity distance (ESQD) arc for the site. Differing ESQD arcs may be required for the same AOC, depending on site conditions and the presence of inhabited buildings, public transportation routes, explosive storage magazines, etc. Formulas that take into account the NEW of the MGFD and the site relationships (i.e., distance from exposed site to MGFD) are used to determine the ESQD for each site. The types of munitions present, or potentially present, at the target AOCs are listed in Table 17-1. These are the munitions that were considered in the selection of the MGFD for each AOC.

Table 17-1: AOCs MEC Characteristics

Size	Nomenclature	Type
MEC found during SI at WVIA		
75 mm	M28 HEAT	Grenade, rifle
2.36 inch	M6 HEAT	Rocket
3.5 inch	M28 HEAT	Rocket

Size	Nomenclature	Type
MD found during SI at WVIA		
75 mm base plate	MK I HE	Projectile
MEC found during USACE EE/CA at Waikane Valley Training Area		
60 mm	M49A3 HE	Mortar
81 mm	M362A1 HE	Mortar
37 mm	MK II HE	Projectile

The 3.5-inch rocket was selected as the primary MGFD since it was the largest munition found during prior investigations within WVIA. Figure A-7 shows the MFD and HFD from the four target areas.

A contingency MGFD was selected for the AOCs because other munitions types were found on adjacent property during the USACE EE/CA. There is also some uncertainty that the selected MGFD absolutely reflects the MEC with the greatest fragment distance, since the WVIA AOCs have not been 100 percent investigated. A contingency MGFD will allow work to continue safely if munitions found are larger than the primary MGFD, but smaller than the contingency MGFD. The contingency MGFD for all AOCs will be the 75 mm projectile.

The primary and contingency MGFDs and the associated hazardous fragmentation distance (HFD) and MFD ESQD arcs for each AOC are shown in Table 17-2. The approved ESS for the project contains figures showing the ESQD arcs. Table 17-2 also contains the ESQD arcs for an intentional detonation with a NEW of 50 pounds (detonation of multiple items and associated donor charges). MEC that is acceptable to move will be accumulated in a temporary collection point for disposal at the end of the day.

Table 17-2: MGFDs and Exclusion Zones for AOCs in WVIA

		EZ (ft)				
		Fragmentation Effects		Blast Overpressure Effects[2/]		
MGFD	NEW[1/] (lb)	HFD[1/]	MFD[1/]	K328	K40	K50
Primary						
3.5″ rocket	1.88	235	1420	457	56	70
Contingency						
75 mm MKI	1.64	238	1,702	411	50	63
Disposal						
Varies[3/]	50	600[4/]	4,970[5/]	1,285[6/]	157	94

Notes:

[1/]Reflects detonation of a single munition with greatest fragment distance (MGFD) item without donor charge.
[2/]NEW, HFD, and MFD from Fragmentation Data Review Forms.
[3/]Reflects detonation of multiple items and associated donor charges.
[4/]DDESB Technical Paper 16, Equation 4-11
[5/]DDESB Technical Paper 16 Table 4.2.
[6/]Standard K-factor formula with 1.2 multiplier (USACE).

EZ = Exclusion Zone HFD = hazardous fragmentation distance
MFD = maximum fragmentation distance NEW = net explosive weight

17.1.1 TEAM COMPOSITION AND SEPARATION DISTANCE

A five-person UXO team consisting of one Team Leader who is qualified as a UXO Technician III (UXOTIII), and four additional personnel qualified as either UXO Technician I or UXO Technician II, will perform intrusive operations. The team may excavate anomalies at four individual locations simultaneously. The entire team may work in one area but must maintain the minimum team separation distance (K40) with other teams.

17.1.2 ENCOUNTERING MEC OTHER THAN THE SELECTED MGFD

If a MEC item is encountered during the course of the investigation that has a greater fragment distance than the selected MGFD or the greatest contingency MGFD, the SUXOS will immediately cease operations in that MRS. The SUXOS will then notify the Remedial Project Manager (RPM), who will submit an amended ESS to MARCORSYSCOM. Work in that MRS may not continue until MARCORSYSCOM has approved the amended ESS.

17.2 WORK ELEMENTS

Table 17-3 presents the various work elements for this project, the SOPs where the procedures for these work elements are discussed and locations in other parts of the plans where additional information on these work elements can be found.

Table 17-3. Project Activities and Supporting Documents

Definable Feature of Work	SOP	Supporting Document(s)
Mobilization/Site Preparation	1	APP, MEC SAP
Surface Clearance	4	MEC SAP, ESS
Intrusive Operations	5	MEC SAP, ESS
MEC/MPPEH Management and Disposal	6, 7	APP, MEC SAP, ESS
Site Restoration	-	MEC SAP
Geophysical Survey (grids & transect)	2	MEC SAP, ESS
Geophysical Data Processing and Interpretation	3	MEC SAP

17.3 MOBILIZATION/SITE PREPARATION

17.3.1 MOBILIZATION

The field management team consists of a Site PM, a SUXOS, a UXOSO, a UXOQCS, and one on-site Emergency Medical Technician. The field management team provides oversight of the surface clearance, subsurface investigation, and MC sampling tasks, which are expected to take approximately 8 weeks to complete. The Site PM will be in daily communication with the USAE Project Manager regarding attainment of DQOs and assessment of data. The Site PM will also coordinate with CH2MHill's site representative, who will visit the site weekly to ensure that CH2MHill is receiving the site data necessary for conducting hazard assessments and evaluation of potential remedial alternatives.

The Site PM and SUXOS will mobilize one week early in order to set up lodging for the rest of the work force, to review the work plans, to establish a field office and geophysical Instrument test strip (ITS) location, to coordinate with supporting subcontractors, to receive shipments of field equipment, purchase field supplies as necessary, and to establish the boundaries of the AOCs shown at Figure A-2.

USAE will utilize 14 personnel in order to accomplish the MEC activities. Local qualified UXO personnel will be hired if available and economically feasible. One team member from Donaldson Enterprises, Inc. (DEI) will provide the required Hawaii Blaster's License in addition to performing regular UXO duties.

The MEC Team mobilizes one week after the Site PM and SUXOS.

17.3.2 INITIAL ORIENTATION AND TRAINING

Prior to beginning field operations, the field management team will confirm that all personnel have the proper training records and are under medical surveillance, and will provided all employees a full day of site-specific training in work plan requirements and equipment operation. This initial training is supplemented throughout the remainder of the project. Training is provided by the Site PM, SUXOS, UXOSO, and UXOQCS, and records of attendance are recorded. Project team archaeologists provide training on recognition of and sensitivity to archaeological features. At a minimum, USAE personnel receive the training specified in WS#8.

17.3.3 ITS PREPARATION AND ANALOG CERTIFICATION

Hand-held analog detection equipment will be used for all MEC surface clearance activities. In order to validate the analog systems (sensors & operators) operability, an ITS will be established in a convenient location that simulates the conditions at the AOCs and permits efficient daily use. The selected location will be checked for background anomalies prior to any seed item placement. If necessary, the test area will be relocated to avoid background anomalies. The test area will be seeded with MEC stimulants (pipe nipples of appropriate sizes) at various depths, orientations, and inclinations. The test area will consist of the following seed item simulants: M9 rifle grenade, 2.36-inch rocket, and 3.5-inch rocket. Three (3) of each seed item type will be buried, one shallow (to confirm detection), and two deep (to establish maximum depth detection capability.

Performance of the analog systems will be evaluated at the ITS. Settings will be optimized to detect the seed items. Any change to the established settings, needed to maximize the test strip detection results while minimizing background responses, will be documented and reported. The ITS will be used as a function check area for daily certification of analog system operability.

A brief analog ITS performance report will be issued documenting the geophysical instrument’s ability to detect the seed items. The report will recommend the initial, best performing settings for the analog surface clearance and subsurface investigation tasks, with the understanding that the geological conditions across the site are likely to vary and may require adjustments to the established settings.

17.3.4 DIGITAL ITS CERTIFICATION

After intrusive investigation of each grid and transect has been completed, DGM equipment will be used to provide a geophysical map of the grid or transect as a record of the analog intrusive action. The DGM data and processed map is not intended as a verification of clearance since this action is an investigation to determine vertical extent and density of MEC within the grid or transect. Prior to use on the grids or transect, the DGM system (EM61-MK2), operators, and positioning system (traditional line/station/ fiducials) will be demonstrated at the ITS.

The ITS will be used to demonstrate that DGM equipment, DGM operators, and DGM Data Processor/Analyst are meeting project DQOs, including performance metrics, data delivery, and documentation, such that the performance criteria of WS#12 are met. The methods and procedures used in this evaluation are detailed in SOP2- DGM Survey, and SOP3 – DGM Data Processing and Interpretation.

Additional in-process DGM QC checks to be conducted include a test seed item, and daily static and dynamic performance testing.

A brief DGM ITS performance report will be issued documenting the geophysical instrument’s ability to detect the seed items. The report will recommend the initial, best performing DGM metrics, with the understanding that geological conditions across the site are likely to vary and may require adjustments to the established DGM metrics.

17.4 BOUNDARY AND GRID LAYOUT

The management team will provide site-specific training, after which USAE personnel will use handheld GPS equipment (e.g. Trimble GeoXH with external antenna or equivalent) to establish approximate boundaries of the AOCs. A 5-meter external antenna cable will be used to extend the antenna as high as possible in the jungle canopy.

Since the surface clearance involves a step-out process to determine the horizontal extent of the AOC, final boundaries will not be established until the completion of the surface clearance. A Professional Land Surveyor (PLS) will survey in the AOC boundaries and establish working grid corners to an accuracy of 0.1 foot. The grids established for subsurface investigations will be 50 feet by 50 feet, or equivalent area as dictated by field conditions. USAE personnel will record the location of any MEC within a grid using tape measures from the PLS established grid corners.

17.5 VEGETATION REMOVAL

Vegetation will be cleared within the established AOC boundaries to a height between 3 and 6 inches using machetes, man-portable weed-whackers, and chain saws. Trees over 6 inches in diameter will not be cut. Vegetation clearance will be limited to cutting of brush, vines, and tree limbs that would directly impede the movement of the detection equipment. Cut vegetation will be cut into approximately 2-foot lengths or mulched in order to minimize migration of cut vegetation to the Waikane Stream.

17.6 SURFACE CLEARANCE

Under this task, the MEC Team performs a systematic surface clearance of 100% of the 4 AOCs and the transect using analog detectors (e.g., Schonstedt GA52Cx magnetometer). If MEC is still being found as the boundary of a target area is reached, USAE will inform the RPM, and will continue surface clearance by stepping out 50 feet in any direction from where the last MEC item is found. The horizontal projection of the target areas is approximately 43.5 acres. In addition, the MEC Team will recover and dispose of the 70 MEC items discovered during the SI.

Two 5-man MEC Teams perform all surface clearance efforts over an estimated 8-week period. Each team is led by one UXO Technician III (UXOTIII) who oversees the work procedures of four UXO Technicians II/I (UXOTII/I). The MEC Team will make in-field decisions based on real-time analysis of the data they collect. Archaeological Monitors will accompany each MEC Team for the duration of the fieldwork to ensure protection of archaeological features.

The work teams systematically traverse each AOC with analog detectors to detect, locate and mark all MEC items encountered, and recover any MEC related scrap that is free of explosives. The UXOTIII organizes the team in a line-abreast formation and directs the movement of the team back and forth across the AOC in a manner that ensures 100% coverage of each AOC. As the team moves forward, the UXOTII/Is use the hand-held detector to assist them in locating metallic items that may be camouflaged by the soil or hidden in vegetation. Whenever the team encounters materials that are potential MEC items the survey line halts and the UXOTII inspects the item. If the item is determined to be munitions debris or non-MEC related scrap the UXOTIII directs the UXOTII to recover the material, and it is removed from the AOC and stockpiled with other munitions debris or non-MEC related scrap. If the item is UXO or a MEC item containing explosives the UXOTIII marks and records the location of the item and notifies the SUXOS. The SUXOS coordinates for disposal of the item by detonation.

To verify the AOC 100% coverage the UXOQCS will emplace BSI at the surface, covered with soil or vegetation so as not to be obvious, at the rate of four per acre. The UXOQCS will record the GPS location of each BSI to help ensure each BSI is recovered.

All surface clearance results are integrated into the project GIS database and reported on AOC maps.

17.7 INTRUSIVE OPERATIONS (AOC CHARACTERIZATION)

Subsurface investigation will consist of 100% investigation of all anomalies within 32 grids to maximum depth of detection. Excavations will cease at 4 feet or if bedrock is encountered at shallower depth. Eight grids, each 1/16 acre in area, will be established in each AOC. At least two grids will be located at the densest occurrence of surface MEC within the AOC, and the remaining 6 grids will be spread across the AOC to enable characterization of moderate and low density areas. A transect 3 feet wide and stretching across the southern end of AOCs 2, 3, and 4 will be subsurface investigated to maximum depth of detection, at a depth of 4 feet, or if bedrock is encountered at a shallower depth.

17.7.1 EXCAVATION OF TARGET

Subsurface investigation is accomplished using two 5-man MEC Teams, each consisting of a UXOTIII and 4 UXOTII/I. Work areas are subdivided into individual work grids, and these grids are further subdivided into individual search lanes to facilitate control of the clearance and to ensure complete coverage of each grid.

Prior to beginning intrusive operations, archaeological monitors conduct a visual inspection of the grid to determine if there are any archaeological features to be avoided. The team may shift subsurface investigation to a different grid if archaeological features must be avoided. Archaeological monitors will be called to the grid to inspect potential cultural material encountered during excavations, and will inspect the excavation locations after completion of the subsurface investigation to ensure that such features have been undisturbed or properly protected.

Individual search lanes are five feet wide, completely transect the grid, and are established in a pattern that ensures 100% coverage. A UXOTII is assigned to each search lane and systematically searches the lane using an analog detector (e.g., Schonstedt GA52Cx magnetometer). The technician moves forward, sweeping the instrument back and forth across the lane in a manner that keeps the tip of the instrument within four to six inches of the ground surface and forming a series of arcs across the lane that are no greater than three to four inches between arcs. During this operation the technician monitors the aural indications produced by the detector and identifies the location of any subsurface metallic anomaly encountered. The UXO Technicians excavate and identify the source of each anomaly as it is encountered. If the anomaly has not been resolved when the target depth is reached in the excavation, work on the excavation is stopped and the reason for not resolving is entered in the "Comments" section of the *Surface/Subsurface Clearance Data & Munitions Accountability Log*: e.g., "Investigation Depth reached, anomaly not resolved."

Throughout the survey the UXOTIII closely monitors the work of the UXOTIIs, records location data for the subsurface anomalies and the results of any investigations performed. Separate records are prepared and maintained for each individual work grid.

Prior to the beginning intrusive operations, the UXOQCS will emplace BSI in investigation grids and in the 3-foot wide transect along the southern boundary of AOCs 2,3, and 4. The BSI density will be 2-4 per grid and one within every 100-foot segment of the 3-foot wide transect. One-to-two BSIs will be buried at shallow depths and 1-2 buried between 90% and 100% of their maximum consistent detection depth as demonstrated at the ITS. The UXOQCS will record the GPS location and depth of each BSI and restore the emplacement site so not to be obvious to the clearance team.

All intrusive results are integrated into the project GIS database and presented on AOC characterization maps.

17.8 MEC/MPPEH MANAGEMENT AND DISPOSAL

17.8.1 MEC ACCOUNTABILITY

On the day designated for MEC disposal activities, the SUXOS and UXOSO will accompany the Demolition Supervisor as each MEC item is prepared for demolition. The group will confirm that all MEC items logged for demolition during the week are located and accounted for, either through demolition or other treatment.

17.8.2 MEC BIP

All munitions items located within the AOCs are classified as MEC or as MDAS. Any other munitions are considered as Material Potentially Presenting an Explosive Hazard (MPPEH) until they are re-inspected and certified as non-explosives contaminated.

All MEC and MPPEH items containing explosives, which are encountered during this project, are disposed of or vented/demilitarized by countercharging the munitions with an explosive donor charge and detonating the donor charge. All explosive disposal operations are performed under the direct supervision of the SUXOS and the UXOSO. Prior to the initiation of any explosive charge, the SUXOS ensures that all required coordination is made with local agencies and that the area is clear of non-essential personnel. DEI provides explosives delivery and blasting services, as they have personnel with the necessary Hawaii Blaster's Permit.

MEC items discovered during the workweek are marked or consolidated as appropriate for a demolition event to occur at the end of the week. Safety considerations require that MEC items which have been fired and are still fuzed must be blown in place (BIP). Where necessary to protect archaeological features, engineering controls (such as earthen barricades or sandbags) will be placed around the MEC items and/or the archaeological feature to prevent fragmentation from reaching archaeological features. Details of explosive operations are contained in SOP 6.

Two UXO qualified personnel identify MEC items/components encountered during the project. The UXO personnel record identification data of all MEC items/components, including condition, nomenclature, depth, location and disposition for inclusion in the RI Report. USA maintains a detailed accounting of all MEC/MPPEH encountered. Once the MEC has been destroyed or removed the hole is checked with an analog detector to assure that the initial item was not masking additional anomalies.

17.8.3 DONOR EXPLOSIVES HANDLING

The DEI representative with the Hawaii Blaster's Permit is designated as Demolition Team Leader for the duration of the demolition operation. The Demolition Team Leader is responsible for handling of donor explosives and set up of the shot. Donor explosives are transported to the site in a vehicle properly licensed and equipped for storage and transport of explosives.

17.8.4 MEC CONSOLIDATION AND DISPOSAL

Where the SUXOS and the UXOSO can determine that a MEC item is not fuzed or is otherwise not configured to detonate, they may make the decision that it is acceptable to move. The MEC item can then be moved to a different location and consolidated with other MEC items for detonation.

17.8.5 MUNITIONS DEBRIS MANAGEMENT

During field operations, USAE recovers, inspects and disposes of MDAS. Only personnel qualified as UXOTII or above are allowed to inspect and classify MDAS. Containers such as 55-gallon drums are used for storage of munitions debris. Total weight of MDAS is documented during certification and verified upon receipt by the recycle facility. Once a container is loaded with MDAS, it is closed and sealed until it is received at the recycle facility. Details of the MDAS inspection process are provided at SOP 7.

17.9 SITE RESTORATION

17.9.1 BACKFILL

Upon completion of excavation activities or demolition activities, inspections of the holes are made to ensure that no anomalies remain. Once the determination has been made that the hole is clear it is back filled with native soil and the location is leveled with the surrounding ground and restored to its prior condition. Sand from sandbags used for engineering controls during demolition is recovered for use in further demolitions or is buried in the hole and covered with native soil.

17.9.2 SCRAP MANAGEMENT

Non-munitions scrap retrieved from the target areas is disposed of at local scrap dealers or landfill disposal areas.

17.10 GEOPHYSICAL SURVEY

Geophysical data acquisition will be performed only in grids and transect for which subsurface investigation has been completed, with the intent of providing a geophysical map of any anomalies remaining within the completed grid/transect. These completed grids and transect will receive 100 percent DGM coverage. The geophysical survey of each grid will be accomplished by collecting data at regularly spaced, overlapping parallel lines. The spacing of these transects will be determined in the ITS; however, based on experience, it is anticipated that the spacing will be 0.75 meter. The heavy vegetation present in the AOCs will have been cleared prior to the subsurface investigation. The 0.75 meter line spacing provides for 25 percent overlap coverage when using the 1 meter wide EM61-MK 2 detector. SOP-2 Geophysical Survey describes the procedures to be used to acquire geophysical data by using ground-based electromagnetic detectors, positioned with traditional line/station/fiducials. The UXOQCS will perform random surveillance to maximize the consistency of the geophysical data collection. Attention will be paid to the consistent height of sensor above the ground as the operator is walking and between operators. Sensor height will be adjusted to be 40±2.54 cm above the ground (or as otherwise determined at the ITS) for each DGM operator. Data collection speed should be consistent across each grid line and between operators. Inconsistencies observed by the team leader, operator, or the UXOQCS will be noted and immediately corrected. To measure data collection quality, a test item program will be implemented. Standardized test items will be used to ensure dynamic detection, location accuracy, and repeatability during the DGM survey. At the start of data collection, anomaly characteristics (peak response and size) of the test items will be established in the first survey grid or a test strip as appropriate, in addition to the daily instrument checks. The UXOQCS will then place these standardized test items in the grids and transects at a rate of 1 per grid or transect and record their locations to substantiate repeatable anomaly characteristics and location accuracy as determined from the first grid test item results. The UXOQCS will record in a test item tracking log the precise location, depth, and orientation of each seed item and verify the ability to locate the seed with the detection equipment used for DGM. During data processing, repeatability of the test item anomaly characteristics (peak response and size) will be reviewed for an allowable variation of +/-25% and a location accuracy within a 1m radius from the seeded location. If any test item does not pass review, a root cause analysis will be performed, and the grid and/or transect will be subject to rework. Details of the Test Item program are included in SOP-2. The UXOQCS will confirm successful data transfer/download of daily DGM data to the Site Geophysicist.

17.11 GEOPHYSICAL DATA PROCESSING AND INTERPRETATION

The purpose of the DGM task is to provide a subsurface anomaly map of the grids and transect that have been previously cleared and QC'd by analog detection methods, and to ascertain the suitability of DGM in relation to the geology and terrain of this site. The DGM effort will not be used as a QC measure. Therefore, geophysical data processing and interpretation will be limited to that necessary to demonstrate that the grid or transect is mapped (site coverage), that static, and dynamic performance metrics established at the ITS are maintained, to confirm the detection and positional accuracy of the EM61-MK2 in identifying and locating standardized test items by comparing against measured distances and repeatable anomaly characteristics, and to interpret any remaining anomalies, following the anomaly selection criteria established at the ITS.

USAE will have collected and processed data from the ITS prior to geophysical data collection and processing. From this data, anomaly characteristics will be determined such that the identification of anomalies will support the project. The parameters analyzed will include the milliVolt (mV) amplitude and apparent size of an item based on its "along-line" and "across-line" signature, signal to noise ratio, and anomaly signal strength. The final anomaly characterization parameters will be established in conjunction with the USAE Project Geophysicist and project representatives to maximize anomaly detection based on the ITS results.

All survey data will be inspected, reviewed, processed, and analyzed by the USAE Site Geophysicist in accordance with SOP-3, Geophysical Data Processing & Interpretation and as demonstrated at the ITS. USAE will utilize sensor manufacture software and Geosoft's Oasis Montaj to process and analyze the geophysical data, insuring that all DGM performance requirements established at the ITS are being met. All datasets will be converted from the line/station/fiducial local coordinates into the project coordinate system, evaluated and corrected for positional latency and leveled as required. Data are then gridded, contoured and displayed on a map for target selection. Targets will be selected from these maps initially by running the data through Geosoft's UX-Detect package. Each of the anomalies selected by Geosoft as a target will be analyzed by the Site Geophysicist, and evaluated as to their validity and position. Targets found to be invalid or incorrectly located will be removed (e.g., targets selected on noise peaks) or relocated. Additionally, anomalies that were not selected by UX-Detect, yet deemed to represent a potential UXO target, will be manually selected (e.g., edge anomalies).

DGM maps and dig lists for each AOC grid or transects are reported/uploaded and integrated into the project GIS database for final reporting. DGM performance metrics from daily static and dynamic checks and production data are reported to document the proper DGM system performance and to document the utility of DGM at this project site.

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WORKSHEET #18: SAMPLING LOCATIONS AND METHODS/SOP REQUIREMENTS TABLE

Sampling Location (Grid) / ID Number	Exclusion Areas	Matrix	Depth relative to Ground Surface (units)	Analytical Group (NA for MEC EHP Site) Alternative Field Name – Survey Methodology	Degree of Investigation or Coverage	Sampling SOP Reference
Target Areas 1, 2, 3, 4	Areas steeper than 30 degrees	Surface Soils	On ground surface	Analog Detector	100% instrument aided surface removal	SOP 4
Grids within Recreational portions of target areas	Below bedrock	Subsurface soils	To 4 feet below ground surface	Analog Detector	100% instrument aided subsurface removal	SOP 5
Grids within Residential portions of target areas	Below bedrock	Subsurface soils	To 4 feet below ground surface	Analog Detector	100% instrument aided subsurface removal	SOP 5
Transect down-gradient from Targets 2, 3, and 4	Below bedrock	Subsurface soils	To 4 feet below ground surface	Analog Detector	100% instrument aided subsurface removal	SOP 5

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WORKSHEET #19: ANALYTICAL SOP REQUIREMENTS TABLE

Note: This worksheet pertains to chemical analysis and related activities and not to MEC Site Inspection.

Matrix	No. of Samples	Analytical Group	Analytical and Preparation Method/SOP Reference[1]	Sample Volume	Containers (number, size, and type)[a]	Preservation Requirements	Maximum Holding Time (preparation/ analysis)

Not Applicable

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WORKSHEET #20: FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

Matrix	Characteri-zation or Removal Procedure	Number of units applicable to QC Survey	No. of Field Duplicates	Number of seed items per grid	No. of Field Blanks	No. of Equip. Blanks	No. of VOA Trip Blanks	No. of PT Samples	Total Number or area of QC Sampling
Surface Soils	Instrument Aided Surface Removal	15 percent QC sweep of all acres surveyed	Not Applicable	2 to 4 seed items per acre	Not applicable	Not applicable	Not applicable	Not applicable	43.5 acres
Subsurface Soils	Intrusive investigation of all detected anomalies in 50 feet by 50 feet grids	15 percent QC sweep of all grids surveyed	Not applicable	2 to4 seed per grid	Not applicable	Not applicable	Not applicable	Not applicable	32 grids

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WORKSHEET #21: PROJECT SAMPLING SOP REFERENCES TABLE

Reference Number	Title, Revision Date and/or Number	Originating Organization of SOP	Title, Revision Date and/or Number	Equipment Type or Instrument	Modified for Project Work?	Comments
SOP 1	Vegetation Removal	USAE	Vegetation Removal	Vegetation removal and mulching equipment	No	
SOP 2	Digital Geophysical Surveying	USAE	Digital Geophysical Surveying	Electromagnetic sensor	No	
SOP 3	Geophysical Data Processing and Interpretation	USAE	Geophysical Data Processing and Interpretation	Electromagnetic sensor	No	
SOP 4	Surface Clearance	USAE	Surface Clearance	Analog Detectors and GPS equipment	No	
SOP 5	Intrusive Operations	USAE	Intrusive Operations	Analog Detectors	No	
SOP 6	Explosive Demolition for Disposal of Munitions	USAE	Explosive Demolition for Disposal of Munitions	Explosives and Demolition Equipment	No	
SOP 7	MPPEH Management	USAE	MPPEH Management	Shipping containers	No	

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WORKSHEET #22: FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION TABLE

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference	Comments
Schonstedt GA-52Cx Magnetometer	Battery Strength Test	3 times/day	Audio response over metallic object	Replace batteries; re-work if necessary	Operator		
	Functional Check	At start of operations	Audio response over ITS standardization item	Assess/correct instrument set-up (cables, settings); perform instrument maintenance; replace unit; re-work if necessary	Operator		
EM61-MK2	Battery Strength Test	At beginning and end of each survey area; after equipment restart	Battery strength 12.0 Volts or greater	Replace batteries; re-work survey area	Operator	SOP 2	
	Static Check	Prior to surveying each transect	Stable instrument drift ± 2 mV over 1-minute interval (after minimum 5-minute warm-up)	Perform instrument maintenance; replace unit if necessary	Operator		
	Standardization Check	After equipment re-start (min. 2 times/day)	±20% of established value	Repair or replace unit; examine data taken since last test-rework if necessary	Operator		
	Visual Data Reviews	End of each survey area	Number of readings consistent with walking pace and sampling rate	Perform instrument maintenance; re-survey transect	Operator		
	Data Download Check	2 times/day	100% of files downloaded	Re-survey transects with lost data	Operator		

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WORKSHEET #23: ANALYTICAL SOP REFERENCES TABLE

Note: This worksheet pertains to chemical analysis and related activities and not to MEC Site Inspection.

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)

Not Applicable

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WORKSHEET #24: ANALYTICAL INSTRUMENT CALIBRATION TABLE

Note: This worksheet pertains to chemical analysis and related activities and not to MEC Site Inspection.

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]

Not Applicable

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WORKSHEET #25: ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION TABLE

Note: This worksheet pertains to chemical analysis and related activities and not to MEC Site Inspection.

Instrument/ Equipment	Maintenance Activity	Testing/Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]

Not Applicable

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WORKSHEET #26: MATERIAL POTENTIALLY PRESENTING AN EXPLOSIVE HAZARD (MPPEH) MANAGEMENT

MPPEH is managed in accordance with DoD Instruction 4140.62, Subject: Material Potentially Presenting an Explosive Hazard, NAVSEA OP 5 Volume 1 and as outlined in SOP 7.

USAE's MPPEH management procedures will ensure that unknown explosive hazards are not present when MDAS is shipped to the qualified recycler/smelter and the chain of custody is maintained until the MDAS is signed for by the qualified recycler/smelter for final processing. The MPPEH procedural requirements include:

- A 100-percent inspection and an independent 100-percent re-inspection of all MPPEH by two fully qualified UXO Technicians
- Procedures to ensure material documented to be an explosive hazard (MDEH), including complete small arms cartridges, is not commingled with MPPEH or MDAS
- Ensure that MDEH is not misidentified as MPPEH or MDAS once the explosive hazards it presents have been identified
- Procedures to ensure that MDAS is not commingled with MPPEH or MDEH
- Ensure that MDAS is not misidentified as MPPEH or MDEH once it has been determined to be safe.

Personnel that are responsible for controlling the transfer of MDAS to the qualified recycler/smelter are designated in writing by the Project Manager to the Commanding Officer of the cognizant Facilities Engineering Command for endorsement to the appropriate Defense Reutilization and Marketing Office or qualified recycling program.

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WORKSHEET #27: SAMPLE CUSTODY REQUIREMENTS

Note: This worksheet pertains to chemical analysis and related activities and not to MEC Site Inspection.

Sample Identification Procedures: NA
Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): NA
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): NA

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WORKSHEET #28: QC SAMPLES TABLE

Note: This worksheet pertains to chemical analysis and related activities and not to MEC Site Inspection.

Matrix	
Analytical Group	
Analytical Method / SOP Reference	

QC Sample	Frequency / Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank						
LCS						
PT						
LFB						

Not Applicable

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WORKSHEET #29: PROJECT DOCUMENTS AND RECORDS TABLE

Project Reports and Records	Generator	Definable Feature of Work	Frequency of Completion	Location/Where Maintained
Monthly Progress Report	PM	All	Once per month	WP/ Project Field Files
Weekly Status Report	PM	All	Once per week	WP/ Project Field Files
Daily Operations Summary	SM/SUXOS	All	Daily	WP, App F/ Project Field Files
Weekly QC Report	UXOQCS	All	Once per week	WP, App F/ Project Field Files
QC Surveillance Checklists	UXOQCS	All	As required	All SOPs
QC Surveillance Tracking Form	UXOQCS	All	As required	WP, App F/Project Field Files
Personnel Qualification Verification Form	UXOQCS	All	As required	WP, App F/Project Field Files
Deficiency Notice	UXOQCS	All	As required	WP, App F/Project Field Files
Deficiency Notice Log	UXOQCS	All	As required	WP, App F/Project Field Files
Nonconformance Report	UXOQCS	All	As required	WP, App F/Project Field Files
Nonconformance Report Log	UXOQCS	All	As required	WP, App F/Project Field Files
Corrective Action Request	UXOQCS	All	As required	WP, App F/Project Field Files
Corrective Action Request Log	UXOQCS	All	As required	WP, App F/Project Field Files
Field Change Request	UXOQCS	All	As required	WP, App F/Project Field Files
Field Change Request Log	UXOQCS	All	As required	WP, App F/Project Field Files
Operator/Instrument Test Form	UXOQCS	Surface Clearance & Intrusive Operations	Daily	WP, App F/Project Field Files
DGM Checklists	Site Geophysicist	Geophysical Survey	As required	SOP 2, Att. 2/Project Field Files
Checklist for Data Processing	Site Geophysicist	DGM Data Processing	Daily	SOP 3, Att. 1/Project Field Files
Weekly DGM QC Report	UXOQCS	DGM Data Processing	Weekly	SOP 3, Att. 2/Project Field Files
Checklist for Data Storage and Transfer	Site Geophysicist	DGM Data Processing	Daily	SOP 3, Att. 3/Project Field Files
Demolition Equipment Checklist	Demo Supervisor	MPPEH Management & Disposal	Each demolition event	SOP 6, Att. 1/Project Field Files
Health & Safety Equipment Checklist	Demo Supervisor	MPPEH Management & Disposal	Each demolition event	SOP 6, Att. 2/Project Field Files
Disposal Operations Checklist	Demo Supervisor	MPPEH Management & Disposal	Each demolition event	SOP 6, Att. 4/Project Field Files
Explosive Disposal Log	Demo Supervisor	MPPEH Management & Disposal	Each demolition event	SOP 6, Att. 5/Project Field Files
MEC Daily Activities Checklist	UXO Team	Surface Clearance &	Daily	SOP 4, Att. 1; SOP 5, Att.

	Leaders	Intrusive Operations		2/Project Field Files
MEC Equipment Checklist	UXO Team Leaders	Surface Clearance & Intrusive Operations	Daily	SOP 4, Att. 2; SOP 5, Att. 3/Project Field Files
Clearance Data and Munitions Accountability Log	UXO Team Leaders	Surface Clearance & Intrusive Operations	Daily	SOP 4, Att. 3; SOP 5, Att. 1/Project Field Files
MEC/MPPEH Log	SM/SUXOS	Surface Clearance & Intrusive Operations	Daily	WP App F/Project Field Files
General Safety Briefing	UXOSO	All	Daily	WP App E, Att. 7/Project Field Files
Tailgate Safety Briefing	UXOSO	All	Daily	WP App E, Att. 7/Project Field Files
Safety Inspection Report	UXOSO	All	As required	WP App E, Att. 7/Project Field Files
Site Visitor Log	SM/UXOSO	All	As required	WP App E, Att. 7/Project Field Files
Accident/Near Miss Report	UXOSO	All	As required	WP App E, Att. 7/Project Field Files
Contractor Serious Incident Report (CSIR)	UXOSO	All	As required	WP App E, Att. 7
Record of Safety Violation/Non Compliance Report	UXOSO	All	As required	WP App E, Att. 7/Project Field Files
Team Logbooks	Team Leaders	All	Daily	Project Field Files
SUXOS Logbook	SUXOS	All	Daily	Project Field Files
UXOSO Logbook	UXOSO	All	Daily	Project Field Files
UXOQCS Logbook	UXOQCS	All	Daily	Project Field Files

WORKSHEET #30: ANALYTICAL SERVICES TABLE

Note: This worksheet pertains to chemical analysis and related activities and not to MEC Site Inspection.

Matrix	Analytical Group	Sample Locations/ID Number	Analytical Method	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number)
NA	NA	NA	NA	NA	NA	NA

Not Applicable

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WORKSHEET #31: PLANNED PROJECT ASSESSMENTS TABLE

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person Responsible for Performing Assessment	Person Responsible for Responding to Assessment Findings	Person Responsible for Identifying and Implementing Corrective Actions (CA)	Person Responsible for Monitoring Effectiveness of CA
Audit of Project Activities	Once during project	Internal	USAE	Program Quality Section	PQCM	Site PM, UXOQCS	PQCM
Personnel Qualifications	Once, plus as new personnel join team	Internal	USAE	PQCM	PM, Staffing Manager	PM, Staffing Manager	PQCM
Accident/Incident Reporting	Per event	Internal	USAE	UXOSO	UXOSO, POSM, Corporate QM	POSM, Corporate QM	UXOSO, Corporate QM
Turn-in of recovered Munitions Debris	Daily	Internal	USAE	UXOTIII	SUXOS	UXOQCS	PQCM
Preventive Maintenance	Daily	Internal	USAE	SUXOS	PM	SUXOS	PM
Communications Equipment Inspection	Daily	Internal	USAE	UXOTIII	UXOSO	UXOSO	UXOQCS
Safety Inspections	Daily	Internal	USAE	UXOSO	SUXOS	SUXOS	UXOSO
Medical Support	Weekly	Internal	USAE	UXOSO	PM	PM	UXOSO
Explosives Transportation	As needed to support operations	Internal	USAE	UXOSO	Donaldson Enterprises, Inc.	Donaldson Enterprises, Inc.	UXOSO
Physical Security (after hours)	As needed	External	MCB Kaneohe Bay	MCB Kaneohe Bay Environmental	RPM	RPM	MCB Kaneohe Bay Environmental

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person Responsible for Performing Assessment	Person Responsible for Responding to Assessment Findings	Person Responsible for Identifying and Implementing Corrective Actions (CA)	Person Responsible for Monitoring Effectiveness of CA
				Office			Office
Vegetation Clearance	Daily	Internal	USAE	SUXOS	UXOTIII	UXOTIII	SUXOS
Analog Detector Operations	Daily	Internal	USAE	UXOQC	UXOTIII	UXOTIII	UXOQC
Excavation Operations	Daily	Internal	USAE	UXOSO	UXOTIII	UXOTIII	SUXOS
MEC/UXO Final Disposal	Weekly	Internal	USAE	UXOSO	SUXOS, Demo Supervisor	SUXOS, Demo Supervisor	UXOSO
UXO MEC Accountability	Weekly	Internal	USAE	UXOSO	SUXOS	SUXOS	UXOSO
DGM Operations	Weekly	Internal	USAE	Project Geophysicist	Project Geophysicist	Project Geophysicist	UXOQC
Safety and Health Program	Weekly	Internal	USAE	POSM	UXOSO	UXOSO	POSM
Visitor Briefing	As needed	Internal	USAE	UXOSO	SUXOS	UXOSO	SUXOS
Site-Specific Training	As needed	Internal	USAE	Corporate QM	PQCM	PQCM	Corporate QM
Hazard Assessment	As needed	Internal	USAE	POSM	UXOSO	UXOSO	POSM
MARCORSYSCOM Audit of MRP Action	TBD	External	TBD	TBD	PM	Site PM, UXOQCS	PQCM

SAP Worksheet #32 – Change Control Management

USAE's Quality Improvement Process comprises the internal systems that evaluate the quality program's effectiveness in ensuring and continually improving the quality of work. The primary goal of the Quality Improvement Process and the QC program as defined in this document is to prevent deficiencies or non-conformances and facilitate continual process improvement. To the extent that the first of these goals is not achieved, identified deficiencies or non-conformances will be corrected in a timely and cost-effective manner and with the intent of preventing their recurrence. This SAP includes provisions for preventing quality problems and facilitating process improvements as well as identifying, documenting, and tracking deficiencies until corrective actions have been verified.

During the course of the project, it is possible that changes to the WP, SAPs, or other implementing documents are required or desired to ensure that the project objectives are met, respond to changes in site conditions, and/or implement methods of improving overall project safety, quality, or productivity, as appropriate (without compromising other project objectives).

Project staff at all levels will be encouraged to provide recommendations for improvements in established work processes and techniques. The intent will be to identify activities that are compliant with the existing plans/procedures, but can be performed in a more efficient or cost-effective manner. Typical quality improvement recommendations include identifying a bottleneck in production and/or recommending an alternative practice that provides a benefit without compromising prescribed standards of quality or safety.

It is important that these changes only be applied after they have been evaluated to ensure that the change will not compromise the project's objectives, quality and/or safety. Therefore, procedures have been developed to ensure that changes are reviewed by USAE and the Navy before implementation. Changes may only be implemented once the appropriate reviews and approvals have been made.

The distribution of the approved WP will be controlled by the PQCM to ensure that the most recent and accepted version is available at all locations where activities essential to the effective functioning of the QC program described herein are performed. Revision numbers and effective dates will be indicated in the document control header. Revisions to this plan will require the same level of approval, control, and distribution as the original; however, it will avoid the necessity of issuing new plans. Revisions will be handled via the Field Change Request (FCR) and Design Change Notice (DCN) process. A DCN will be used to document changes to the scope of work, plans, specifications/drawings, or to reflect significant changes in the QC or health and safety programs. Under this process, replacement pages may be issued for insertion into the approved project plans. All changes must be accompanied by the FCR form with appropriate approval signatures.

32.1 FIELD CHANGE REQUEST/DESIGN CHANGE NOTICE

Changes to designs, plans or procedures will be documented using the FCR form. This form will document the Navy's concurrence with changes. DOH will be given an opportunity to review all field changes and concur. An FCR is used to request and document changes identified as a result of unanticipated field conditions or identification of field activities that are procedural and will not affect the original schedule, design specification, quality, safety, or scope of work. The FCR forms are signed by the NTR to acknowledge the changed condition. Only when the FCR has received approval from all reviewers will the change be implemented. FCRs will be discussed in the weekly QC meeting and included in an After Action Report.

32.1.1 FCR/DCN Initiation

The UXOQCS, SUXOS, and/or the Site PM may initiate an FCR/DCN individually or collectively by completing Sections 1 to 3 of the FCR or DCN form, as appropriate. The FCR/DCN is then submitted to the Project Manager who coordinates review of the FCR with the PQCM, and Program Occupational Safety Manager (POSM), if health and safety related.

The FCR/DCN must be brought to the immediate attention of the Project Manager. If implementation of the DCN would result in a change in the cost, scope of work, design, or result in significant project delays or work stoppage, the PM shall immediately notify the Government, as appropriate.

32.1.2 FCR/DCN Review

The Project Manager receives the FCR or DCN and coordinates the review process. Each FCR/DCN shall be sequentially numbered as follows:

- FCR or DCN-Waikane-YYY, where YYY is the FCR or DCN number, beginning with 001

The appropriate managers and the PQCM must be included in the review process. The Project Manager must also review the FCR/DCN if production related and the POSM must be included in the review process if the FCR/DCN involves health and safety issues. All involved managers must complete, sign, and date Section 4 of the FCR/DCN to indicate their approval. The PQCM shall review the FCR/DCN after all other reviews have been completed and promptly forward the FCR/DCN to the Navy RPM and NTR for approval. In the case of a DCN, the request for approval is sent to the Contracting Officer. All FCR/DCN will be discussed as part of the weekly QC meeting.

32.1.3 FCR Implementation

Each approved (or rejected) FCR/DCN will be copied to all management signatories, the Site PM, SUXOS, UXOQCS, UXOSO and other personnel as deemed appropriate by the Project Manager. A copy of each approved (or rejected) FCR/DCN will also be retained in the contract file and included as part of the Final Report.

FCRs/DCNs will be tracked on the FCR/DCN Tracking Form. This form will be continually updated through the FCR/DCN Approval Phase, and will also track FCRs/DCNs that are rejected.

The Site PM and/or SUXOS shall implement the approved FCR/DCN in the field. All FCR, DCN, deficiency notices, non-conformance reports and the status/logs will be discussed during the Weekly QC Meeting and included in the After Action Report.

32.2 DEFICIENCY MANAGEMENT

All deficiencies or nonconforming conditions discovered during inspections or other QC functions will be noted on a Deficiency Notice (DN) or a non-conformance report (NCR), as appropriate. Deficiency Notices are used to document the failure to develop, document, or implement effectively any applicable element of approved plans or to follow established procedures. A deficiency could lead to a non-conformance. An NCR documents a deficiency that renders the quality of an item, process, or product that has been defined in the specifications or drawings as unacceptable or indeterminate. The DN or NCR will identify, at minimum, any corrective action identified, the individuals reviewing and approving of the actions, and the actions taken to prevent recurrence. DN and NCR logs will be maintained to document and track corrective actions to closure.

The PQCM will be responsible for tracking deficiencies to closure and reporting their status on daily reports and log forms. The PQCM will discuss deficiencies with the project team during the weekly QC meeting and memorialize all issues in the After Action Report. If a deficiency has the potential to result in a need for re-work or jeopardizes the quality of future work to the extent that re-work may be required, the PQCM will be expected to stop work or recommend and implement immediate corrective action to address the deficiency.

32.2.1 Corrective Action

Once a process displays a characteristic out of specification with those required for the project or quality objectives, corrective action must be conducted to identify the cause of the deficiency or non-conformance. When the cause of the problem is identified, appropriate corrective action can be instituted and then monitored for effectiveness.

32.2.2 Root Cause Analysis

Determining the root cause of a non-conformance is an integral part of the QC process. The depth and extent of the root cause analysis depends on the situation; the root cause may be as simple (minor) as an overlooked step or procedure or it may be complicated. Root cause analysis is the responsibility of the functional manager or a designee. Input can be obtained as necessary from field personnel and technical advisors in order to identify the factors that led to the problem. The root cause is almost always "upstream" from where the problem is detected. A two-step strategy will be employed for determining the root cause of a deficiency or nonconformance for this project. First, the problem will be traced back to the source. Second, the cause will be evaluated using basic questions such as who, what, when, where, why, and how. This process will be repeated until the cause is identified.

32.2.3 Implementation of Corrective Action

Following the root cause analysis, the project personnel will undertake the most effective remedy to correct the problem. Potential remedies to be considered may include the following:

- Supplemental personnel training
- Changes of equipment or modification of equipment currently in use
- Acquisition of supplemental equipment
- Implementation of new procedures or modification of existing procedures
- Changes in QC procedures

Successful implementation of corrective action will be documented on the deficiency notice or NCR. Through follow-up phase surveillance, the UXOQCS will verify that the corrective action implemented has rectified the non-conforming condition and is sufficient to prevent recurrence. The results of the corrective action will be presented in the interim After Action or Final Report, as appropriate.

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WORKSHEET #33: QC MANAGEMENT REPORTS TABLE

Type of Report	Frequency (Daily, Weekly, Monthly, Quarterly, Annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Daily QC Report	Daily	By noon the following day	PQCM	Navy RPM, QA Contractor
QC Meeting Minutes	Weekly	COB of second day after QC Meeting	PQCM	Navy RPM, QA Contractor
Project QC Report	Draft and Final	Appendix to RI/FS Report	PQCM	Navy RPM, HDOH
QC Project Checklist	Once at beginning of project	At first QC meeting	PQCM	Navy RPM, QA Contractor
Preparatory Phase Inspection Form	One for each DFW before start of work	By noon of following day	PQCM	Navy RPM, USAE PM
Initial Phase Inspection Form	One for each DFW before start of work	By noon of following day	PQCM	Navy RPM, USAE PM
Follow-up Phase Inspection Form	One for each DFW each week activities are conducted	By noon of following day	PQCM	Navy RPM, USAE PM
UXO Monthly Project QC Report	Monthly	Attached to Daily QC Report for last day of each month	PQCM	Navy RPM, USAE PM

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WORKSHEET #34: VERIFICATION (TIER 1) PROCESS TABLE – PREPARATORY AND INITIAL INSPECTIONS

A preparatory phase inspection will be performed prior to beginning each DFW. The purpose of this inspection is to review applicable specifications and verify the necessary resources, conditions and controls are in place and compliant before the start of work activities. An initial phase inspection will be performed at the beginning of each DFW. The purpose of this inspection is to observe/review the application of procedures to ensure their adequacy, ensure adequate resources are applied to the activity and that a cleat understanding exists as to the quality control requirements of the DFW. The responsible person will inspect the relevant items from the checklist in the SOP.

Definable Feature of Work	Supporting QC Document(s)	Responsible for Verification (Name, Organization)
Mobilization/Site Preparation	Pre-Construction Meeting, Verification of Personnel Qualifications/Training Checklists, Plans Acknowledgement Signature Sheets, MEC SAP WS 17, SOP-2 Surface Clearance Preparatory/Initial Checklist, SOP-1 Vegetation Removal Preparatory/Initial Checklist	USAE Project QC Manager and UXOQCS
Surface Clearance	SOP-4 Surface Clearance Preparatory/Initial Checklist	USAE UXOQCS
Intrusive Operations	SOP-5 Intrusive Operations Preparatory/Initial Checklist	USAE UXOQCS
MEC/MPPEH Management and Disposal	SOP-6 Explosives Demolition Preparatory/Initial Checklist, SOP-7 MPPEH Management Preparatory/Initial Checklist	USAE UXOQCS
Geophysical Survey	SOP-2 Geophysical Survey Preparatory/Initial Checklist	USAE Project Geophysicist and UXOQCS
Geophysical Data Processing/Interpretation	SOP-3 Geophysical Data Processing Preparatory/Initial Checklist	USAE Project Geophysicist and UXOQCS
Site Restoration	MEC SAP WS 17, Environmental Protection Plan (Section of the WP), and Site-specific Restoration Preparatory/Initial Checklist	USAE Site PM and UXOQCS

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WORKSHEET #35: TIER 2 QC PROCESS SUMMARY TABLE

Follow-up inspections are conducted to ensure that procedures are being correctly preformed, no changed conditions exist which may impact the quality of work and lessons learned are being captured and applied. The UXOQCS will inspect the applicable follow-up items from the checklist in the listed SOP (the site-specific checklist for Site Restoration is included in SOP-5), as often as specified in the chart below. Worksheet 32 describes actions to be taken in the event that nonconforming conditions are observed during the QC inspections.

Definable Feature of Work	Frequency of Inspection	Supporting QC Document(s)	Responsible for Verification (Name, Organization)
Mobilization/Site Preparation	N/A	No Follow-up required for this DFW	
Surface Clearance	Minimum of one team per day	SOP-4 Surface Clearance Preparatory/Initial Checklist	USAE UXOQCS
Intrusive Operations	Minimum of one team per day	SOP-5 Intrusive Operations Preparatory/Initial Checklist	USAE UXOQCS
MEC/MPPEH Management and Disposal	Weekly and per demolition event	SOP-6 Explosives Demolition Preparatory/Initial Checklist, SOP-7 MPPEH Management Preparatory/Initial Checklist	USAE UXOQCS and SUXOS
Geophysical Survey	Minimum of one team per day	SOP-2 Geophysical Survey Preparatory/Initial Checklist	USAE Project Geophysicist and UXOQCS
Geophysical Data Processing/Interpretation	Per data set	SOP-3 Geophysical Data Processing Preparatory/Initial Checklist	USAE PQCM and Project Geophysicist
Site Restoration	Weekly and a final walk through at completion of field activities	MEC SAP WS 17, Environmental Protection Plan (Section of the WP), and Site-specific Restoration Preparatory/Initial Checklist in SOP -5	USAE Site PM and UXOQCS

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SAP Worksheet #36 – Product QC Tier 3 Process Summary

The actions taken to investigate each AOC will be documented and submitted for an AOC Certification. A certification package is prepared by the contractor for review by the Navy. This package will document the steps taken to ensure the quality of the information relied upon to develop the RI Report and subsequent Feasibility Study.

USAE's certification process encompasses five steps taken to ensure data quality. Step I documents and reviews the preparatory QC activities for each DFW (see WS #34). Step II summarizes and reviews the initial and follow-up phases of QC inspections and certification (see WS #35). Step III reviews documentation of pre-intrusive surface clearance and the specific quality requirements for geophysical processing and interpretation. Step IV is a review of MEC clearance operations including review of follow-up phase QC checklists and compliance with the MEC SAP surveillance requirements. Step V documents USAE's actions to ensure that all MEC items have been cleared from the AOC using blind seed items (BSI) and a resurveying 15% of each grid and transect (randomly selected area).

All five steps are fully documented and packaged for review by the USAE AOC Certification Team. The team is comprised of the Site PM, the UXOQCS, the Project geophysicist, and the SUXOS. The team will certify each step of the quality process has been completed and forward the package for approval by USAE's PM and PQCM, prior to submission to the Navy for approval. Upon Navy approval, the package is forwarded to stakeholders as noted above.

The process steps are more fully discussed in the following sections.

36.1 QC TIER I: PRE-OPERATIONAL PREPARATION

Step I of the AOC Certification process includes verification of training, personnel qualifications, construction of the ITS and ITS certification testing of all geophysical and UXO teams and equipment, grid layout and vegetation removal. Surveillance checks ensured the completion and documentation of mandatory pre-operational preparation. For each production team, a Preparatory Phase Checklist will be used to document training, personnel qualifications, and equipment status. A Three-Phase Inspection Checklist has been developed for each DFW, to be completed prior to beginning work associated with the DFW. Appropriate SOP checklists will be completed on each project field team prior to the actual performance of the investigation activities. The Three-Phase QC Checklist incorporates the Preparatory, Initial, and Follow-Up QC inspection phases into one combined checklist. The Preparatory Phase portion of the checklist will be used during the pre-operational training step of project operations. This QC checklist will document that all the pre-operational actions delineated in the SOPs have been met and that each field team is prepared to conduct field MEC clearance operations. A punch list of individual team deficiencies discovered during the Preparatory Phase will be provided to the Site PM, PQCM, Project Geophysicist, and the SUXOS for corrective action. A record of the completed checklists will be maintained in the AOC QC file, the site QC file, reported in the Daily QC Report, and discussed in the Weekly QC Meeting.

Geophysical and UXO field teams will be tested through the ITS prior to commencing actual field operations. A, ITS Certification Form, documenting Geophysical and UXO team members by name, search equipment serial numbers, and ITS score, will be maintained in each field team's QC file. Each field team must obtain a minimum score of 0.85 probability of detection.

36.2 QC STEP II: INITIAL AND FOLLOW-UP PHASE OF QC INSPECTION AND SURVEILLANCE

Step II of the AOC Certification/QC process documents that the definable features of work were completed in accordance with the contract specification, WP and approved SAPs and SOPs. The Initial and Follow-Up Phase checklists have been incorporated into the Three-Phase QC Inspection Checklist process within each SOP. The Initial and Follow-Up Phase checklists will be used to document that all aspects of the remedial action are completed in accordance with the applicable procedures. The combined checklists are designed to verify that the SOP-specific sampling and analysis, geophysical surveying, and MEC clearance procedures are being followed during the performance of remedial action field operations. Information to be included in the SOP-specific three-phase checklists consists of:

- Teams performing geophysical and intrusive UXO work at project field sites were successfully ITS certified for the entire time that they performed the field work leading to the completion of clearance activities in an AOC grid.
- Grid corners are certified as being placed in the correct location(s).
- QC surveillance forms for Geophysical and UXO field teams have documented that each team has followed the appropriate SOP for the fieldwork being conducted.
- All AOC grids have been geophysically surveyed by an EM61 MK2 in accordance with this plan and verified by database-generated grid maps.
- All BSIs were identified in the analog geophysical surveys and recovered.
- Inspections of DGM anomaly lists to verify that all BSI target anomalies have been detected and accurately reported.
- All MEC items found in an AOC grid have been properly disposed.
- All grids within an AOC have been completed prior to submission of AOC documentation to the AOC Certification Team, which will certify completion of the RA objectives.
- All site restoration efforts performed in accordance with this plan.

A record of the completed checklists will be maintained in the AOC QC file, the site QC file, and reported in the Daily QC Report.

36.3 QC STEP III –QC OF DIGITAL GEOPHYSICAL MAPPING

Step III verifies the independent verification of the DGM task. Initially, the Project Geophysicist will ensure independent verification of DGM processing and interpretation of the geophysical data for each grid collected by the project geophysical teams (total number of grids is anticipated to be 32, plus one transect).

The independent verification team will generate an anomaly list and the Project Geophysicist will compare it with the anomaly list of the production team. If discrepancies between the two target sets exist, the Project Geophysicist, and the Site Geophysicist will compare processing techniques. QC discrepancy is defined as:

- 20 percent differential in picks between the two teams; or
- Failure to identify a BSI as a pick.

It is anticipated that this combined effort will start during ITS testing and will continue throughout the duration of the project. This initial duplicative process will ensure that geophysical interpretation criteria, as it relates to data quality objectives, will be consistent and, potentially, improve whenever differences arise in an effort to exceed performance standards.

36.4 QC STEP IV: INTRUSIVE MEC CLEARANCE OPERATIONS

Step IV operations will be a continuation of Step II. An SOP specific Follow-Up checklist, along with appropriate QC surveillance forms, will document that the UXO Teams are properly conducting MEC clearance and MC-contaminated soil removal operations in accordance with the approved procedures.

WS #35 of the MEC and MC SAPs provides the frequency of inspection for the DFW.

A copy of each QC surveillance report will be filed in the AOC QC file, the site QC file, and reported on the Daily QC Report.

36.5 QC STEP V – FINAL GRID INSPECTION

The grid will have QC activities performed to ensure the effectiveness of the MEC removal. Details regarding the steps taken during the grid certification process are provided in the following sub-sections.

36.5.1 QC Inspection Criteria

During the Intrusive QC Inspections, recovery of any MEC/MPPEH item or ferrous metal equivalent in size to such items within the investigation depth (4 feet bgs) means that there is a potential quality issue with the work; a QC failure will be the result. Non-detection of a QC BSI is also considered a QC failure If a QC failure occurs, then the entire grid becomes a potential critical non-conforming unit, and the UXOQCS will provide a root cause analysis to the NTR along with planned corrective actions and/or recommendations (see Section 32.2 for deficiency management procedures).

36.5.2 Intrusive Grid QC

After each grid (or step-out) is completed, the UXOQCS will randomly select 15 percent of each sample grid and investigates any anomalous features remaining. If the anomaly is a MEC/MPPEH item or ferrous metal equivalent in size to such items recovered within the investigations depths listed above, the grid will fail and the failure will be evaluated as described in Section 32.2.

36.5.3 Grid Approval

Once all grids within the AOC have passed QC inspection, the PQCM and his team will formally document the QC efforts for the AOC and recommend that it either pass QC or will recommended additional activities necessary for it to pass QC. The NTR will then be informed that the AOC is ready for review by the Navy's independent QA contractor.

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WORKSHEET #37: USABILITY ASSESSMENT – AOC CERTIFICATION CHECKLIST

The following is an example form to be completed during the AOC Certification Process for each AOC (note: the transect will be added to the AOC 4 certification checklist).

Waikane RI/FS AOC Certification Checklist

QC Step	Items to be checked/verified	Grid 1	Grid 2	Grid 3	Grid 4	Grid 5	Grid 6	Grid 7	Grid 8
QC Step I	Verified Qualifications/Training Checklist has been completed for all personnel.								
	Have the WP, MEC SAP, and APP been reviewed by UXO teams during the preparatory phase?								
	Discrepancies found in the Preparatory Phase checklist have been corrected prior to Initial Phase Inspections for UXO teams.								
	Verified Preparatory Phase 1 Checklist has been completed for all DFWs/SOPs.								
	Have the WP, MEC SAP, and APP been reviewed by GEO teams during the preparatory phase?								
	Discrepancies found in the Preparatory Phase 1 checklist have been corrected prior to initial Phase Inspections for GEO teams.								
	Verified ITS constructed as prescribed in WS #17								
	Verified UXO Team(s) met ITS Certification.								
	Verified GEO Team(s) met ITS Certification.								
	Verified boundary and grid layout conform to tolerances in WS #17								
	Signatures on appropriate documents (SOPs, forms, etc.)?								
QC Step II	Verification that the initial and follow-up three-phase quality control checklists have been completed for UXO team(s).								
	Discrepancies found in the initial and follow-up three-phase quality control checklists have been corrected and documented for the UXO team(s).								
	Have all personnel assigned to the UXO team been ITS Certified?								
	Have all equipment assigned to the UXO team been ITS Certified?								
	Verification that the initial and follow-up three-phase quality control checklists have been completed for GEO team(s).								

Waikane RI/FS AOC Certification Checklist									
QC Step	**Items to be checked/verified**	Grid 1	Grid 2	Grid 3	Grid 4	Grid 5	Grid 6	Grid 7	Grid 8
	Discrepancies found in the initial and follow-up three-phase quality control checklists have been corrected and documented for the GEO team(s).								
	Have all personnel assigned to the GEO team been ITS certified?								
	Have all equipment assigned to the GEO team been ITS Certified?								
	Signatures on appropriate documents?								
	Verify 100% Production BSIs recovered								
QC Step III	Verified that the Project Geophysicist re-processed random 5 percent of grid geophysical pick lists.								
	Verified that the Project Geophysicist compared QC and GEO targets.								
	Discrepancies have been investigated and the results have been documented.								
	Appropriate actions have been taken by the PQCM regarding the results of the QC Phase III investigation.								
	Signatures on appropriate documents?								
QC Step IV	Verification of follow-up checklist or quality control surveillances have been completed for all UXO teams.								
	Discrepancies found in the follow-up three-phase quality control checklist or quality control surveillances have been corrected and documented.								
	Verify that surveillances in the MEC SAP were completed?								
	Signatures on appropriate documents?								
QC Step V	If non-confirming units were found, corrective actions followed the MEC SAP.								
	Discrepancies corrected and surveillances written.								
	QC Step V Random Sampling inspection samples were identified and investigated.								
	Discrepancies have been investigated and the results have been documented for the Step V surveillance.								

Waikane RI/FS AOC Certification Checklist									
QC Step	**Items to be checked/verified**	Grid 1	Grid 2	Grid 3	Grid 4	Grid 5	Grid 6	Grid 7	Grid 8
	Signatures on appropriate documents?								

SIGNATURES	**NAMES**	**SIGNATURES**	**DATES**

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ATTACHMENT A: MEC STANDARD OPERATION PROCEDURES (SOP)

This attachment contains the following MEC SOPs:

1 Vegetation Removal
2 Digital Geophysical Surveying
3 DGM Data Processing
4 Surface Clearance
5 Intrusive Operations
6 Explosive Demolition for Disposal of MEC
7 MPPEH Management

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STANDARD OPERATING PROCEDURE
FOR

VEGETATION REMOVAL

SOP 1

AREAS OF CONCERN (AOC)

WAIKANE VALLEY IMPACT AREA
KANEOHE, HAWAII

USA ENVIRONMENTAL, INC.

February 2010

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APPROVALS

This standard operating procedure (SOP) contains the procedures and other information that will be needed by USA Environmental, Inc. (USAE) field staff to conduct vegetation removal activities on sites containing material potentially presenting an explosive hazard (MPPEH) during the activities at AOCs at the Waikane Valley Impact Area. By their signatures, the undersigned certify that this SOP is approved for implementation at WVIA and will be used to direct surface clearance operations.

Robert Nore Project Manager	Date
Thomas Bernitt Program Quality Control Manager	Date
TBD Senior UXO Supervisor	Date

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the activities described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure the SOP contains current procedures. If a major change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

____ ______________________

TBD Date
Senior UXO Supervisor

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform in accordance with the SOP, I will stop the process and notify my immediate supervisor.

Worker's Name	Date	Supervisor's Name	Date

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ATTACHMENT 1. PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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1. PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide USA Environmental, Inc. (USAE) employees and subcontractors with the minimum procedures and safety and health requirements applicable to perform vegetation removal operations on sites contaminated with munitions and explosives of concern (MEC) or material potentially presenting an explosive hazard (MPPEH).

2. SCOPE

This SOP applies to all USAE site personnel, including contractor and subcontractor personnel, involved in the conduct of vegetation removal operations on a site potentially contaminated with MEC/MPPEH. This SOP is not a stand-alone document and should be used together with Work Plans, other USAE SOPs, the Site Health and Safety Plan (SHSP), applicable Federal, State, local regulations, and contract restrictions and guidance.

3. SELECTION

Only those personnel who meet the requirements set forth by the client and USAE will be utilized at the project site to facilitate safe and efficient vegetation removal operations.

4. TRAINING

All training on equipment and PPE will be either formal or on-the-job (OJT) training. This training will be documented by site personnel and subject to review for accuracy and completeness.

5. WORK CLOTHING AND FIELD SANITATION

Work clothing will be appropriate for the conditions encountered. In most cases, this will be Level D PPE, which includes the following.

- Short- or long-sleeved cotton coveralls or work clothing will be worn.
- Footwear is sturdy work boots or rubber boots as appropriate (i.e., lug sole and of sufficient height for ankle support). UXO personnel will not wear steel-toe safety boots when using metal detectors.
- 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, face shields, respirators, hearing protection, hard hats and protective chaps or aprons will be available and worn when personnel are engaged in activities where their use is prudent or required.
- In no case will tennis/running shoes or abbreviated attire such as tank tops or shorts be permitted.

The team will be outfitted with field decontamination equipment, which will consist of containers of wash water, paper towels, and soap. Good housekeeping and decontamination measures will be practiced.

6. TEAM COMPOSITION

The Vegetation Removal Team will consist of up to 5 qualified personnel. These personnel will include the following:

- 1 - UXO Technician III
- 4 - UXO Technicians II or I

6.1 UXO TECHNICIAN III

The UXO Technician III (Team Leader) is UXO qualified and directs the operation and other team personnel within the context of removal requirements. In addition, the UXO Technician III must be familiar with the equipment being utilized.

6.2 OPERATOR

The operator(s) will be UXO Technicians qualified and trained on the equipment being utilized (e.g., weed eater, chain saw, etc.) and operate the equipment in a safe and efficient manner. The operator performs daily inspections and maintenance functions as recommended in the operator's manual. The operator will perform other duties as needed or directed.

7. SAFETY

Safety is paramount and all personnel will observe those safety precautions/warnings that apply or may apply to vegetation removal operations. The precautions listed below are general in nature and personnel will need to review applicable publications for more specific safety precautions/warnings. Distances listed are the minimum required.

- Maintain a Team Separation Distance (TSD) from other teams in accordance with Department of Defense Explosives Safety Board (DDESB) TP-16.
- Maintain safe separation distance from UXO personnel engaged in intrusive work.
- Use equipment safety features.
- Safety precautions/warnings found in the operator's manual/manufacturer's publications will be observed.
- Maintain 4 to 6 inches of ground clearance during vegetation cutting operations.
- Communications will be maintained between the Team Leader and Operator(s) at all times.
- Maintain site control.
- Observe MEC safety precautions for items encountered or suspected.
- Ensure PPE is appropriate, serviceable, and worn/used in a proper manner.

8. OPERATIONAL PROCEDURES

Vegetation clearance will be limited to cutting of brush, vines, and tree limbs that would directly impede the movement of the detection equipment. Trees over 6 inches in diameter (as measured 4-feet above ground level) will not be cut. Vegetation will be cut into approximately 2-foot lengths or mulched and spread over the cut area, further ensuring control of runoff. At down-slope boundaries, vegetation will be undisturbed as much as possible to ensure a vegetative buffer strip is left in place to control sediments.

The UXO Technician III will be responsible for 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, which may include MEC/MPPEH, terrain slope, vegetation, wildlife, environmental concerns, and PPE requirements. The UXO Technician III will perform a visual search for MEC/MPPEH, surface debris, and any other obstruction/object that may pose a hazard to team personnel. Hazardous items, impassable terrain, or vegetation that may affect operations will be marked and team personnel notified.

Prior to operations commencing, a communications check with all team personnel 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. The hand signals will be documented on the tailgate safety briefing sheet each morning of operations and at each change of team personnel.

Personnel will not enter within 10 ft of an operating piece of equipment. If at any time personnel enter closer than 10 ft, the Operator will immediately stop, return the engine to idle speed, and cease operations.

Team personnel are to ensure that a 4-inch to 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 the Senior UXO Supervisor (SUXOS) and/or UXO Safety Officer (UXOSO) as needed. All MEC/MPPEH items encountered are marked and avoided. Notification of these items will be made to the appropriate personnel.

9. SUMMARY

USAE personnel will conduct vegetation removal operations in a safe, efficient, and productive manner and will use this SOP and references, which include changes and revisions.

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ATTACHMENT 1.
PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST AND QC SURVEILLANCE

MRC N62742-05-D-1868, CTO0010

VEGETATION REMOVAL

TEAM INFORMATION		
Team:	**Location:**	**Date:**
Team Leader:		
Personnel Present:		
Phase of Inspection (Circle): ***Preparatory (P); Initial (I); Follow-Up (F)***		

CHECKLIST

ITEM	REF.	INSPECTION POINT	YES	NO	N/A	COMMENTS
1	**SOP-1 Workers' Statement**	Have all Vegetation Removal Team Members reviewed SOP 1, Vegetation Removal for WVIA?				*(P)*
2	**SOP-1, Sec. 6**	Are all Vegetation Removal Team Members trained and qualified to operate removal equipment?				*(P), (I), (F)*
3	**SOP-1, Sec. 6**	Is the PPE serviceable and properly worn by all team members?				*(P), (I), (F)*
4	**EPP & WS#17, Sec. 17.9**	Have all team members familiar with the Environmental Protection Plan and WS#17, Sec. 17.9 restoration requirements?				*(P)*
5	**SOP-1, Sec. 7&8**	Was vegetation removed and treated in accordance with Section 7&8?				*(P), (I), (F)*

FINDINGS

Item	Comments

Conducted By: ____________________ **Reviewed By:** ____________________

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STANDARD OPERATING PROCEDURE
FOR

DIGITAL GEOPHYSICAL SURVEYING

SOP 2

AREAS OF CONCERN (AOC)

WAIKANE VALLEY IMPACT AREA

KANEOHE, HAWAII

USA ENVIRONMENTAL, INC.

February 2010

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APPROVALS

This standard operating procedure (SOP) contains the procedures and other information that will be needed by USA Environmental, Inc. (USAE) field staff to conduct geophysical survey activities for material potentially presenting an explosive hazard (MPPEH) during the operations at AOCs at Waikane Valley Impact Area, Kaneohe, Hawaii. By their signatures, the undersigned certify that this SOP is approved for implementation at WVIA and will be used to direct geophysical survey operations.

Alan Crandall Project Geophysicist	Date
Thomas Bernitt Program Quality Control Manager	Date
TBD Senior UXO Supervisor	Date

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the procedures described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure the SOP contains current procedures. If a major change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

______________________________ ______________________
TBD Date
Site Geophysicist

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform in accordance with the SOP, I will stop the process and notify my immediate supervisor.

Worker's Name	Date	Supervisor's Name	Date

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ATTACHMENT 1. EM61 AND DGPS OPERATION

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ATTACHMENT 3. PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
BSI	Blind Seed Item
CD	Compact disc
CQC	contractor quality control
DGM	Digital Geophysical Mapping
DGPS	differential global positioning system
DMM	Discarded Military Munitions
DQO	data quality objective
EMI	electromagnetic induction survey
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
ESS	Explosives Safety Submission
FTL	Field Team Leader
GIS	geographic information system
GPO	Geophysical Prove-Out
GPS	Global Positioning System
HE	High Explosive
MC	Munitions Constituents
MD	Munitions Debris
MDAS	Material Determined as Safe
MDAH	Material Determined as an Explosive Hazard
MEC	munitions and explosives of concern
MPPEH	Material Potentially Presenting an Explosive Hazard
NAVFAC PAC	Naval Facility Engineering Command, Pacific
PCMCIA	personal computer memory card international association
PDA	Personal Digital Assistant
POC	Point of Contact
PQCM	Program QC Manager
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RTK	Real-Time Kinematic
SHSP	Site Health and Safety Plan
SOP	standard operating procedure
TDEM	time-domain electromagnetic
USAE	USA Environmental, Inc.
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
WMP	Waste Management Plan

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DEFINITIONS

Apparent Conductivity—One of the quantities measured during an electromagnetic induction survey; it is proportional to the bulk conductivity of subsurface materials.

Apparent Resistivity—The quantity measured during a resistivity survey; it is proportional to the bulk resistivity of subsurface material.

Conductivity—The ability of a material to transfer an electric current; equal to the inverse of resistivity.

Current—The quantity of charge transmitted per unit time.

Electromagnetic Induction (EMI) Survey—A geophysical exploration method whereby electromagnetic fields are induced in the ground and the resultant secondary magnetic field is measured and interpreted. Can use either frequency or pulse (time) methods.

Potential—The voltage with respect to a reference value.

Resistivity—Inherent property of a substance, equal to the resistance of a body multiplied by its cross-sectional area and divided by its length.

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1. PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and technical guidance on performing geophysical surveys to detect material potentially presenting an explosive hazard (MPPEH) during the MEC activities at the AOCs at WVIA. The geophysical instrumentation will be used in conjunction with line/station/fiducial positioning during the investigation. In addition, this SOP ensures that data will be acquired and processed in a consistent manner during this clearance. It also identifies general quality control (QC) procedures to be performed by field personnel and verification points for use by the Site Contractor Quality Control (CQC) Representative.

For the purposes of this SOP, all munitions/ordnance-related items are considered to be MPPEH until they are subjected to dual certification/verification inspections. If the item is determined to contain high explosives (HE), it is re-categorized as Material Determined as an Explosive Hazard (MDEH). If the object inspections show no HE, it is re-categorized as Material Determined as Safe (MDAS). Other sub-classifications may include unexploded ordnance (UXO), discarded military munitions (DMM), explosives munitions constituents (MC), or munitions debris (MD).

2. SCOPE

This SOP outlines the procedures used for the collection of geophysical and associated coordinate data. USAE will use the Geonics EM61-MK2, a high-resolution time domain electromagnetic induction sensor capable of detecting both ferrous and non-ferrous metallic objects in conjunction line/station/fiducial positioning to detect subsurface metallic objects.

To ensure that the instrumentation can attain an acceptable measure of performance, a geophysical test program will be initiated prior to the start of field activities. The primary objectives of the test program are to validate the use of the EM61-MK2 time-domain electromagnetic (TDEM) sensor and positioning system and to determine the detection performance for the purpose of assessing the adequacy of the planned sampling approach.

3. MAINTENANCE

The Site Geophysicist, in collaboration with the Site CQC Representative, is responsible for the maintenance of this procedure. Approval authority rests with the Project Geophysicist and the Program QC Manager (PQCM).

4. PREPARATORY ACTIVITIES

4.1 GRID AND TRANSECT SURVEY AREA SET-UP

Before conducting geophysical mapping all grid corners, transect start, inflection, and end points will be surveyed, staked, and recorded by the project PLS in accordance to the WP and MEC QAPP. All surveyed points will be marked with survey stakes and high visibility marking paint. The PLS will deliver all survey information to the USAE GIS Manager and Project Geophysicist. The GIS manager will provide a map to the Site Geophysicist showing the location of each grid and or transect, and a list of coordinates for all grid corners and transect way points. The following procedures are for grid and transect set-up methods to be followed at the AOCs and transect for geophysical surveys by the DGM teams.

4.2 TEST ITEM PROGRAM

To measure data collection quality, a test item program will be implemented. Standardized test items (e.g. standard pipe nipples) will be used to ensure dynamic detection and repeatability during the DGM survey. At the start of data collection, anomaly characteristics (peak response and size) of the test items will be established in the first survey grid or a test strip as appropriate. The DGM team will then place these standardized test items in the grids and transects at a rate of 1 per grid or transect to substantiate repeatable anomaly characteristics as determined from the first grid test item results. The DGM team will record in a test item tracking log the precise location, depth, and orientation of each seed item and verify the ability to locate the seed with the detection equipment used for DGM. During data processing, repeatability of the test item anomaly characteristics (peak response and size) will be reviewed for an allowable variation of +/-25%. If any test item does not pass review, a root cause analysis will be performed, and the grid and/or transect will be subject to rework.

4.3 DATA COLLECTION PARAMETERS

Final data collection parameters will be determined based on the evaluation of the ITS data. These parameters include

- Lane spacing
- Sensor height
- Data collection speed
- Data collection intervals

5. EQUIPMENT AND GEOPHYSICAL DATA COLLECTION PROCEDURES

5.1 EQUIPMENT

To support this task, USAE will use EM61-MK2 digital geophysical mapping (DGM) sensors to detect buried metallic anomalies. The digital sensor will be used to acquire site data for processing and analysis. Data positioning will consist of traditional line/station/fiducial positioning that will be implemented through the use of tape measures and marked ropes (fiducials) placed at known locations across the survey area.

Other support equipment includes field computers to support data transfer, processing, analysis, and archiving, printers, and computer networking equipment.

5.2 GEOPHYSICAL DATA COLLECTION PROCEDURE

The following set of procedures is subdivided for grids and transects DGM surveys for this project. Attachment 1 provided step-by step instructions for equipment operation.

5.2.1 EACH SURVEY LOCATION

1. Turn on the EM61-MK2. Perform morning daily QC tests (see Attachment 1).
2. Proceed with the geophysical survey. Daily survey procedures include:
   - Sensor warm up for at least 5 minutes.
   - Sensor nulling check.
   - Input and record file name for survey.
   - Begin acquiring survey data.

- Monitor EM61-MK2 sensor and batteries periodically.
- Maintain correct lane spacing (2.5ft in grids) and record fiducials at correct intervals (25ft).
- Continue until area is completely covered, battery needs replacing (e.g. backpack battery reaches <=12.0 volts or data logger battery reaches last segment), or a break is required.
- Download morning survey data and lunch break.
- Change and charge batteries, as required.
- Acquire afternoon survey data and afternoon QC tests.
- Download afternoon survey data with instrument checks.
- Secure the EM61-MK2 and positioning equipment.
- Charge all batteries overnight.
- The logbook pages are photocopied and transferred to the Site Geophysicist.
- The data files are submitted to the Site Geophysicist.
- The completed survey areas are recorded in the tracking log and/or reported to the Site Geophysicist.
- The logbook pages are accessible for verification by the Site CQC Representative who may inspect them weekly.
- Plan next day's activities.

3. One member of the team will be responsible for maintaining the logbook. Record the following information in the logbook:
   - Survey area ID
   - Time survey started
   - Time survey completed
   - Names of team members
   - Weather conditions
   - Serial numbers of geophysical instrumentation
   - File names for the digitally recorded data. Each page of the logbook will be dated, sequentially numbered, and identified by the logbook number; all entries will be signed. The assigned DGM team member will place photocopies of the logbook pages in the appropriate folder located in the processing center at the end of each work day.

5.2.2 GRID DATA ACQUISITION

The use of traditional line/station/fiducial positioning will be implemented with tape measures and marked ropes (fiducials) placed at known locations across the grids. To maintain appropriate line spacing, tape measures will be utilized along the North and South boundaries of the grids with a parallel rope placed at the 7.62m (25ft) centerline of the grid with alternating color codes painted along the rope at 0.75m (2.5ft) spacing during data collection. Data will be collected utilizing local coordinates referenced to the established southwest corner of each grid, the line position across the grid (e.g., every 2.5 ft), and fiducials at the 0, 25, and 50 ft marks along the grid. The known grid corners, established by the PLS, will allow the geophysical data to be converted from local coordinates into the project Coordinate System with the correct units. Any obstacles that affect survey line lengths will be mapped and the corresponding line lengths measured and recorded. A Field Data Sheet (Attachment 2) will be used to capture and document each survey grid. Daily survey procedures are described in section 5.2.1 and Attachment 1.

5.2.3 TRANSECT DATA ACQUISITION

The use of traditional line/station/fiducial positioning will be implemented with tape measures and marking paint or cones (fiducials) during the DGM transect survey. The centerline of the 5 foot wide transect will be marked between survey stakes with tape measures or ropes and fiducial markers placed every 7.62m (25ft). Two parallel lines of overlapping data will be collected along the transect. Data will be collected in discreet sections between every transect survey stake utilizing local coordinates referenced to each sections start point with fiducials every 25 feet. The known start, inflection, and end point established by the PLS, will allow the geophysical data to be converted from local coordinates into the project Coordinate System with the correct units. A Field Data Sheet (Attachment 2) will be used to capture and document all relevant information along the transect segments. Daily survey procedures are described in section 5.2.1 and Attachment 1.

5.3 EM61-MK2 SURVEY DATA COLLECTION AND RECORDING

EM61-MK2 survey data include all electronic geophysical instrument data produced during the survey, logbooks, photographs, and survey forms. Procedures for use of the EM61-MK2 are provided in Attachment 1.

5.3.1 DGM TEAM DATA DELIVERABLES

The DGM team will document all aspects of their activities using the following checklists and forms:

- Checklist for Daily Instrument Checks (see Attachment 2)
- Survey Area Report Form (see Attachment 2)
- Checklist for Data Storage and Transfer (see Attachment 2)
- Checklist for Field Editing (see Attachment 2)
- Test Item Tracking Log

These checklists and forms will be reviewed daily by the UXOQCS.

5.3.2 PHOTOGRAPHS

Digital photographs will be taken of all geophysical survey areas. Digital photographs will also be taken to document site conditions and/or obstructions during geophysical surveying (e.g. standing water, debris, or slopes greater than 30 degrees). Each team will maintain a photo log in their field logbook. The date, time, and subject of each photograph will be recorded at the time the photograph is taken. The digital cameras and copies of the photo logs will be given daily to the Site Geophysicist for entry into the photo tracking form and upload to the project computer.

6. QUALITY CONTROL

Quality Control procedures for the geophysics element of this project can be found in the WP and MEC Quality Assurance Project Plan (MEC QAPP). To maintain consistency, each geophysical instrument used for field activities will be listed according to make, model, and serial number in the field logbook/forms and in the digital data files Daily QC tests will be performed and results documented in the project files. In addition, test data will be stored on magnetic media or in field logbooks. Procedures for data tracking, media backup, and survey documentation can be found in SOP 3. Documentation of any geophysical instrument adjustments will be maintained in the project files.

6.1 DAILY QUALITY CONTROL TESTS

The DGM team will set up the equipment, verify that all equipment has survived transportation and is operational, and perform the following daily quality control tests:

- Sensor warm up of at least 5 minutes each time the sensor is turned on
- Sensor nulling
- Acquire Morning Static check for (metrics are for all 4 EM61-MK2 time gates or as established at the ITS:
  - Background for 1 minute (2 mV peak to peak)
  - Spike test for 1 minute (+/- 20% of standard item response after background correction)
  - Return to Background for 1 minute (2 mV peak to peak)
  - 30 seconds of cable shake (Data profile does not exhibit data spikes)
  - 30 seconds of Operator/Personnel testing (2 mV peak to peak)
- Latency test over a known object in opposite directions [repeatability of response amplitude +/- 20%, positional accuracy +/- 20 cm (7.9 inches)]

The Site Geophysicist will transfer these morning QC tests (e.g. exchange memory cards) while the DGM team begins production DGM. The QC tests will be examined for conformance to project metrics.

At the end of each survey day acquire the Afternoon Static check for:

- Background for 1 minute (2 mV peak to peak)
- Spike test for 1 minute (+/- 20% of standard item response after background correction)
- Return to Background for 1 minute (2 mV peak to peak)
- Latency test over a known object in opposite directions [repeatability of response amplitude +/- 20%, positional accuracy +/- 20 cm (7.9 inches)]

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ATTACHMENT 1.
EM61 AND DGPS OPERATION

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EM61-MK2 OPERATION

The following is intended to provide general instructions for data acquisition with an EM61-MK2 geophysical instrument when using line/station/fiducials for data positioning. The manufacturer's instruction manual should be consulted for other questions.

The following procedures are provided to assist in establishing a consistent data acquisition process. The procedures will be adhered to during data acquisition activities to ensure that the data collected are of sufficient quantity and quality to meet the program objectives. The Site Geophysicist is responsible for ensuring that these guidelines are followed, and that the data acquisition staff is adequately trained to operate the equipment.

EM61-MK2 Setup:

1. Assemble coil assemblies
2. Attach wheels and handle or stretcher [as demonstrated at the Instrument Test Strip (ITS)]
3. Connect upper coil to lower coil connector or attach shorting plug for bottom coil only
4. Attach battery to backpack
5. Connect coil cable to backpack
6. Connect data cable to backpack and Data Logger COM1
7. Move to an electromagnetically clean area
    a. Set the EM61-MK2 Mode Switch to:
        i. 4 – for logging four (4) bottom coil time gates
    b. Set the Master/Slave Switch to M for single sensor operation
    c. Push In the Circuit Breaker on the EM61-MK2 backpack and warm up for at least 5 minutes.
    d. Push the ON/OFF button to turn on the Data Logger
        i. Set Antenna Coil Size (e.g. Standard 1 x .5 m)
        ii. Set Up Logger
            1. Date
            2. Time
            3. Units (e.g. feet)
            4. COM port (e.g. COM1)
            5. Audio
            6. Pause Key: (e.g. Alt F1 or any key)
            7. Display (e.g. Text or Graphic)
        iii. Set GPS Port
            1. GPS Input: (Disabled)
            2. COM Port (COM2)
            3. Baud Rate: (9600 or higher)
            4. Parity: (No)
            5. Data Bits: 8
            6. Stop Bits: 1
            7. Can monitor GPS data in terminal mode
        iv. Set Output Port – Not used unless logging data to external PC
    e. Monitor/Null Coils – After 5 minute warm-up, null EM61-MK2 – all channels should be close to 0 +/- 1 mV

f. Acquire Data:
   i. Create File (see data logger software manual)
   ii. Survey Setup (see EM61-MK2 manual) with Reads per second = 10 or greater
   iii. LOG DATA
      1. Wait for data display (0 to 100% internal calibration)
      2. Observe time gate values
      3. Enter to log data– System is ready to log data. Move to start of survey line.

g. When coil is centered over start point, press ENTER again. Display will show “logging” on the top display line. Observe coil readings. Observe Station Number (STN). Note any unusual recordings on Field Survey Sheet.

h. Walk along survey line slowly (about 2.5 to 3 feet per second). Periodically observe Data Logger display. Note any unusual recordings, any deviations from the survey line, or any observed surface metal objects. Escort should log these observations and marks the outer coil edge with marking paint or plastic pin flags to insure sensor overlap on a return transect.

(If fiducial marks are available, press thumb button when coil is centered over mark for 1 second)

i. Press Pause Key (e.g. Alt F1 or Any Key) when coil is centered over the line end to stop logging EM61-MK2 data.

(If in the Auto mode, simply continue to next line and keep moving until survey session is complete or manually set new lines)

j. When survey is complete, exit logging. Enter a new file name to continue surveying, or return to main menu to transfer data.

k. Data Transfer (may vary with controller-see manufacturer’s owner manual)

Data Management in Data Logger

l. Once data transfer is complete and data has been positioned, exported (*.xyz file), and processed successfully, clear the data logger memory

Daily EM61 Static Check

1. Setup as above (metrics are for all 4 EM61-MK2 time gates or as established at the ITS
2. In a quiet area, log static EM61 background data for 1 minute (observe meter readings near 0, +/- 2-3 mV)
3. Pause and increment line
4. Place a “known object (e.g. a Standard Static Test Bar with steel bolt)” on the coil and log data (Enter) for 1 minute (observe meter readings #> 0, +/- 2-3 mV)
5. Pause, remove target, and increment line
6. Log static background data for 1 more minute (observe meter readings near 0 +/- 2-3 mV)
7. Pause, and increment line
8. Log static data for 30 seconds while all system cables are shaken (observe meter readings near 0 +/- 2-3 mV – no jumps or spikes),
9. Pause, and increment line
10. Log static data for 30 seconds while operators kick towards coil, twist left/right, and bend up/down (observe meter readings near 0 +/- 2-3 mV).
11. QC checks:
    a. Look for near zero readings during lines 0, 2, 3, and 4 – re-null coil or replace battery as necessary
    b. Check for consistent target readings +/-20% on line 1 from previous readings. Replace battery as necessary

Daily Latency Check

1. Setup as above
2. Find a quiet area at least 50 feet long
3. Place a known object in the center of this line (e.g. 2” Tow Ball)
4. Acquire line 0 from start (0,0) to end (0,50) directly over the object (0,25)
5. Increment the line number and acquire line 1 from end (0,50) to start (0,0) directly over the object (0,25)
6. Use this data to help determine data processing latency parameter needed to get the peak to line up in both directions.

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ATTACHMENT 2.
DGM CHECKLISTS

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CHECKLIST FOR OUT OF BOX EQUIPMENT TESTS

Project Name: ____________________

Project Location: ____________________

Contractor POC: ____________________

Equipment Source: ____________________

Equipment Serial Numbers: ____________________

____

Reviewer's Name and Title: ____________________

Date of Review: ____________________

	Y	N	N/A
1. Has the equipment been inventoried and inspected for damage or wear?			
2. Has the cable shake test been performed? (Replace any faulty components if necessary)	____	____	____
3. Has the instrument (EM only) been nulled?	____	____	____
4. Has a nearby, noise-free site been selected for static background and static response tests?	____	____	____
5. Have the following instrument function tests been successfully performed:	____	____	____
• Static background test demonstrating <20% deviation in response for at least 3 minutes?	____	____	____

Background values: TG1__________, TG2___________, TG3____________, TG4____________

	Y	N	N/A
• Instrument response test demonstrating <20% deviation in response from test to test?	____	____	____

Response values: TG1__________, TG2___________, TG3____________, TG4____________

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CHECKLIST FOR INITIAL INSTRUMENT TESTS

Project Name: ____________
Project Location: ____________
Contractor POC: ____________
Equipment Source: ____________
Equipment Serial Numbers: ____________
____
Reviewer's Name and Title: ____________
Date of Review: ____________

	Y	N	N/A
1. Has the six-line test been utilized to evaluate the following factors:			
• Heading effects?	____	____	____
• Repeatability of the response amplitude?	____	____	____
• Positional accuracy?	____	____	____
• Latency?	____	____	____
2. If magnetics data are to be collected, have the following steps been taken in the performance of the azimuthal test:	____	____	____
• Selected an area free of geophysical noise?	____	____	____
• Fixed sensor head position?	____	____	____
• Marked four cardinal directions on ground?	____	____	____
• Collected data using a variety of sensor head orientations?	____	____	____
3. If magnetics data is to be collected, has the octant test been performed and documented?	____	____	____
4. Has the optimum sensor height for each instrument been determined?	____	____	____
5. Has the pull-away test been performed and successfully demonstrated no influence for navigational or towing equipment?	____	____	____

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CHECKLIST FOR DAILY INSTRUMENT CHECKS

Project Name: ____________________

Project Location: ____________________

Contractor POC: ____________________

Equipment Source: ____________________

Equipment Serial Numbers: ____________________

____

Reviewer's Name and Title: ____________________

Date of Review: ____________________

	Y	N	N/A
1. Has the RTK DGPS Reoccupation check been performed (+/- 7.62 cm (0.25 ft) from known location)?			
2. Has the cable shake test been performed? (Replace faulty components if necessary)	____	____	____
3. Has instrument (EM only) been nulled?	____	____	____
4. Has a static background test been performed (metrics for all 4 EM61-MK2 time gates or as established at GPO and demonstrated <20% deviation in response over at least 1 minute:			
• Start of day?	____	____	____

Background values: TG1__________, TG2___________, TG3____________, TG4____________

	Y	N	N/A
• End of day?	____	____	____

Background values: TG1__________, TG2___________, TG3____________, TG4____________

	Y	N	N/A
1. Has instrument response test been performed and demonstrated <20% deviation in response from test to test:			
• Start of day?	____	____	____

Response values: TG1__________, TG2___________, TG3____________, TG4____________

	Y	N	N/A
• End of day?	____	____	____

Response values: TG1__________, TG2___________, TG3____________, TG4____________

	Y	N	N/A
1. Has the operator been thoroughly examined with the geophysical instrument for any sources of response that may not be readily apparent?	____	____	____
2. Has the repeat data or "clover-leaf" tests been utilized to evaluate the following factors:			
• Repeatability of response amplitude?	____	____	____
• Proper Lag Correction Applied?	____	____	____
• Positional accuracy?	____	____	____

Has there been an equipment or DQO metric failure?
Document any failure:

Document any corrective action (repair/retest)

Has corrective action solved failure?

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SURVEY AREA REPORT FORM

☐ QC checked by: _____________ ☐ QA checked by __________

Date: _____________ Date: ________

Project Name: _____________________________________, **Project Location:** _______________________________________

Geophysical Contractor: ____________________________, **Design Center POC:** ___________________________________

Project Geophysicist: _______________________________, **Site Geophysicist:** _____________________________________

Survey Area ID: ___________ **Date:** ______________, **Field Team:** ____

Survey Type: ☐Grid ☐Meandering Path ☐Transect ☐Other ______________ **Unit of Measure:** ☐ meters☐ feet

Coordinate System: ☐UTM ☐State Plane NAD ______ ☐Local ☐Other ____

Sketch of Survey Area: **Approx. Scale:** _____________ **North Arrow:**

Terrain: ☐Level ☐Moderate Slope ☐Steep (≥30°) ☐Rolling ☐Ruts ☐Gullies ☐Rocky ☐Swampy ☐Dangerous

Tree Cover: Tree Height: ___________

☐None ☐Light ☐Medium ☐Thick

Brush:

☐None ☐Light ☐Medium ☐Thick

Weather:

☐Sunny ☐Cloudy ☐Drizzle ☐Rain

☐Thunderstorms ☐Hail ☐Fog ☐ Humid☐ Snow

Grid Corner Coordinates:

	UTM/State Plane	**Local**		**Start**	**End**
SW	__________, __________	__________, __________	**Battery Voltage:**	________	________
NW	_________, _________	_________, _________	**Static Backgnd Values:** _____ _____ _____, ______		
NE	_________, _________	_________, _________	**Static Response Values:** _____ _____ _____, ______		
SE	_________, _________	_________, _________	**Static File Name:** ______________________________		

Instrument Clock Drift:____________

Raw Data File Name: _______________________________ **Repeat Data File Name:** ________________________________

Geophysical Instrumentation: ____ **Serial Number:** __________________

Sensor Separation (if applicable)**:** ____________________**; Source** (rental agency, contractor, etc.)**:** ______________________

Base Station: _____________________________________; **Source:** ________________**Serial Number:** __________________

Navigation Method: ______________________________; **Source:** ________________ **Serial Number:** ___________________

Additional Comments: ____

____

____

____

CHECKLIST FOR DATA STORAGE AND TRANSFER

Project Name: ____________________

Project Location: ____________________

Contractor POC: ____________________

Reviewer's Name and Title: ____________________

Date of Review: ____________________

	Y	N	N/A
1. a. Has the transfer medium been approved by contractor?	____	____	____
b. Are all files in approved formats?	____	____	____
c. Have all of the following been included in the transfer packet:			
• "Read me" file detailing contents?	____	____	____
• Raw data files?	____	____	____
• Edited data files?	____	____	____
• GPS positioning files (if separate)?	____	____	____
• Completed geophysical maps?	____	____	____
• Prioritized target lists?	____	____	____
• Data File Log / Spreadsheet of Delivered Data Files with Dates Sent?	____	____	____
1. d. Have the required number of copies, per contract, been included in the transfer packet?	____	____	____

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CHECKLIST FOR FIELD EDITING

Project Name: ____________________

Project Location: ____________________

Contractor POC: ____________________

Reviewer's Name and Title: ____________________

Date of Review: ____________________

	Y	N	N/A
1. Have the following items been evaluated for correctness and edited if necessary:			
• Line numbers?	____	____	____
• Start and end points?	____	____	____
• Line direction?	____	____	____
• Fiducial locations?	____	____	____
2. Has the data been examined in profile and evaluated for geophysical noise (all 4 Em61-MK2 time gates or as established at ITS)? Enter background noise value and compare with ITS background:___________ vs. _________	____	____	____
3. Has the data been examined for the presence of drop-outs and spikes?	____	____	____
4. Has the presence of metal on the operator been eliminated as a possible source of geophysical noise?	____	____	____
5. Has the edited data been converted to the appropriate .xyz format?	____	____	____
6. If using magnetics, have the following steps been taken:			
• Examined base station data for any problems?	____	____	____
• Performed diurnal correction to field magnetometer data?	____	____	____
7. Has the positional data been evaluated for accuracy and completeness?	____	____	____

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Attachment #3 PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST AND QC SURVEILLANCE

MRC N62742-05-D-1868, CTO0010

GEOPHYSICAL SURVEY

TEAM INFORMATION		
Team:	**Location:**	**Date:**
Team Leader:		
Personnel Present:		
Phase of Inspection (Circle): ***Preparatory (P); Initial (I); Follow-Up (F)***		

CHECKLIST						
ITEM	**REF.**	**INSPECTION POINT**	**YES**	**NO**	**N/A**	**COMMENTS**
1	**SOP-2 Workers' Statement**	Have Geophysical Survey Team Members reviewed SOP-2, Geophysical Processing for WVIA?				*(P)*
2	**MEC SAP, WS#7**	Are the Project and Site Geophysicist knowledgeable of their roles and responsibilities?				*(P)*
3	**MEC SAP, WS#8**	Have Geophysical Survey Team Members met the training requirements?				*(P)*
4	**SOP-2, Attach. 2**	Were the out of the box equipment checks performed and documented?				*(P)*
5	**SOP-2, Attach. 2**	Were the initial instrument checks performed and documented?				*(I)*
6	**MEC SAP WS#17**	Have all Geophysical Survey Team Members been certified at the ITS prior to conducting data collection?				*(P), (I), (F)*
7	**SOP-2, Attach. 2**	Was a Survey Area Report Form completed for each grid/transect?				*(P), (I), (F)*
8	**SOP-2, Sec 5**	Was Geophysical Data Collection Procedures followed?				*(P), (I), (F)*
9	**SOP-2, Sec 6**	Were daily QC test conducted before and after data collection?				*(P), (I), (F)*
10	**SOP-2, Attach. 1**	Were equipment, static and latency checks performed and documented?				*(P), (I), (F)*
11	**SOP-2, Attach. 2**	If field editing was done, was it documented on the Checklist for Field Editing?				*(P), (I), (F)*
12	**SOP-2,**	Was the Data Storage and				*(P), (I), (F)*

CHECKLIST						
ITEM	**REF.**	**INSPECTION POINT**	**YES**	**NO**	**N/A**	**COMMENTS**
	Attach-2	Transfer Checklist completed for each data set?				

FINDINGS	
Item	**Comments**

Conducted By: ___________________________ **Reviewed By:** _________________________________

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Attachment #4 MEC Equipment Checklist

MEC EQUIPMENT CHECKLIST

Basic Equipment (Required for all UXO work)

✓	Quantity	Item Description
☐	1	Metal detector, EM61-MK2 (per team)
☐	1	Emergency eye wash
☐	1	Fire extinguisher
☐	1	First-Aid/trauma kit (equipped for white phosphorus burns)
☐	1	Flashlight
☐	1 pair	Gloves, leather (or other approved work gloves) (per team member)
☐	2	Radios (2-way)
☐	TBD	Pin flags (non-metallic)
☐	2 rolls	Tape, duct
☐	1	Toolbox, general hand tools
☐	--	Field log book and field forms (as appropriate)
☐	6	Water, drinking

Site-Specific Items (Write in items and quantity)

✓	Quantity	Item Description
☐		____________________
☐		____________________
☐		____________________
☐		____________________

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STANDARD OPERATING PROCEDURE
FOR

DGM DATA PROCESSING

SOP 3

AREAS OF CONCERN (AOC)

WAIKANE VALLEY IMPACT AREA
KANEOHE, HAWAII

USA ENVIRONMENTAL, INC.

February 2010

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APPROVALS

This standard operating procedure (SOP) contains the procedures and other information that will be needed by USA Environmental, Inc. (USAE) field staff to conduct MEC operations for material potentially presenting an explosive hazard (MPPEH) during the activities at AOCs at Waikane Valley Impact Area, Kaneohe, Hawaii. By their signatures, the undersigned certify that this SOP is approved for implementation at WVIA and will be used to direct surface clearance operations.

Alan Crandall Project Geophysicist	Date
Thomas Bernitt Program Quality Control Manager	Date
TBD Senior UXO Supervisor	Date

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the activities described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure that the SOP contains current procedures. If a major change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure that the process is stopped until the hazards have been eliminated.

______________________________________ ______________________

TBD Date
Site Geophysicist

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform in accordance with the SOP, I will stop the process and notify my immediate supervisor.

Worker's Name	Date	Supervisor's Name	Date

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
BSI	Blind Seed Item
CD	Compact disc
CQC	contractor quality control
DGM	Digital Geophysical Mapping
DGPS	differential global positioning system
DQO	data quality objective
EMI	electromagnetic induction survey
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
ESS	Explosives Safety Submission
FTL	Field Team Leader
GIS	geographic information system
GPS	Global Positioning System
HE	High Explosive
ITS	Instrument Test Strip
MD	Munitions Debris
MEC	munitions and explosives of concern
MPPEH	Material Potentially Presenting an Explosive Hazard
NAVFAC NW	Naval Facility Engineering Command, Northwest
PCMCIA	personal computer memory card international association
PDA	Personal Digital Assistant
POC	Point of Contact
PQCM	Program QC Manager
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RTK	Real-Time Kinematic
SHSP	Site Health and Safety Plan
SOP	standard operating procedure
TDEM	time-domain electromagnetic
USAE	USA Environmental, Inc.
UTM	Universal Transverse Mercator
UXO	unexploded ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
WMP	Waste Management Plan

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DEFINITIONS

Apparent Conductivity—One of the quantities measured during an electromagnetic induction survey; it is proportional to the bulk conductivity of subsurface materials.

Apparent Resistivity—The quantity measured during a resistivity survey; it is proportional to the bulk resistivity of subsurface material.

Conductivity—The ability of a material to transfer an electric current; equal to the inverse of resistivity.

Current—The quantity of charge transmitted per unit time.

Electromagnetic Induction (EMI) Survey—A geophysical exploration method whereby electromagnetic fields are induced in the ground and the resultant secondary magnetic field is measured and interpreted. Can use either frequency or pulse (time) methods.

Intrusive Investigation—Excavating for suspected UXO items or for plotted anomalies. Excavation will be by hand or will be conducted using heavy equipment as deemed appropriate.

Non-Intrusive Investigation—Locating/investigating UXO on the surface of the ground where excavation is not required.

Potential—The voltage with respect to a reference value.

Resistivity—Inherent property of a substance, equal to the resistance of a body multiplied by its cross-sectional area and divided by its length.

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1. PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide general procedures for geophysical data processing and interpretation during field activities for the MEC activities at WVIA.

2. SCOPE

This procedure applies to the data collected during the surveys using geophysical equipment. It applies to all aspects of geophysical data management and quality control from collection, through processing and analysis, to production of intrusive investigation packages and data transfer to the project database and geographic information system (GIS). The major elements of this procedure are electronic data transfer, data processing, data interpretation, data archiving, and data tracking.

3. MAINTENANCE

The Site Geophysicist, in collaboration with the Contractor Quality Control (CQC) Representative, is responsible for the maintenance of this procedure. Approval authority rests with the Project Geophysicist and Program Quality Control Manager (PQCM).

4. PROCEDURES

4.1 TRANSFER OF FIELD DATA AND DATA TRACKING

Several files are generated by the geophysical systems for each site surveyed. These data are stored on the geophysical data logger(s) during data acquisition activities. At the end of the day, the data collected by each field team will be turned over to the Site Geophysicist. These files are uploaded to the data management computer in the Waikane Field Office via PCMCIA (or equivalent) media (see Attachment 3, Checklist for Data Storage and Transfer). The following file types are generated for each survey:

- Geophysical data file with signal intensity and position (relative or absolute) measurements
- Digital photo files (*.jpg).
- Logbooks
- Survey Area Report Form (Attachment 2 SOP 2 Geophysical Surveying)
- Test Item Tracking Log

All EM61-MK2 data files will be electronically logged upon receipt. The following items will be recorded in an Excel spreadsheet or MS Access database for each EM61-MK2 file collected:

- AOC
- Grid, transect, Instrument Test Strip (ITS), etc.
- Geo Team designator
- Date collected
- GPS file name (if necessary)
- EM61-MK2 file name
- EM61-MK2 start and stop times.

The EM61-MK2 and line/station/fiducials positioning data will be processed on site or at an off site processing center.

If the data has been interpreted offsite, the selected target anomaly locations will be sent from the processing center to the Waikane Field Office. The target anomaly locations will be added to the project database. The following information will be added to the Excel spreadsheet or MS Access database:

- Date anomaly file received
- Number of anomalies
- Date anomaly data added to project database.

In addition to the Excel tracking spreadsheet (or MS Access database), the contractor will digitally track all files uploaded to and downloaded from Waikane. In the event of an electronic transmission error, contact will be made with the appropriate center to resend the file. Specifics of the error and date and time of transmission will be recorded at the remote processing or on-site processing center. The tracking file(s) will be available for QC personnel upon request.

4.2 DATA PROCESSING, ANALYSIS, AND INTERPRETATION

Data will be interpreted using a combination of Geonics (or equivalent) and Geosoft Oasis Montaj (or equivalent) software to provide the coordinate location information for each target (see Attachment 1, Checklist for Data Processing). All anomaly interpretation methods used for the grids and transect data will be finalized from the Instrument Test Strip results. As necessary, color-coded images are generated for transect and grid-based data to assist intrusive excavation personnel with dig list information.

The primary interpreter of the data will be a qualified, degreed geophysicist. As a quality control measure, the project geophysicist will review at least 10 percent of the data (200 linear feet or 4 grids) interpreted by the primary interpreter. The specific data reviewed will be documented in MS Access project database.

Oasis Montaj will be used to generate color-coded images of the EM61-MK2 data for each survey grid or transect. Potential target locations will be selected using a combination of two target selection methods; automatic and manual. The automatic method utilizes the target selection algorithm within the Geosoft Oasis Montaj software (e. g. gridpeak.gx). This procedure selects anomaly locations based solely on the signal intensity. The second method (herein referred to as "manual") utilizes a data interpreter who manually selects potential target locations using data characteristics such as the signal intensity from the coil and different time gates, anomaly footprint, anomaly shape and trend, track line characteristics (i.e., spatial sample density), terrain, previous intrusive information, the ITS results, and comments entered by the data acquisition crew regarding geology, terrain, weather, etc. The automatic target selector will select a pipeline, known cultural feature, or terrain-induced "noise" while the manual selection procedure generally will not. However, the automatic target selector prevents the interpreter from potentially "missing" an anomaly; i.e., it provides immediate feedback to the interpreter in the form of a quality control check. The automatic target selector amplitude will be set to a value that is determined during analysis of the data from the ITS.

Based on past experience, the size range of the items of interest for the project includes small pieces of fragmentation up to 3.5-inch rockets. The interpreter will not attempt to differentiate MEC items from non-MEC items. If the interpreter selects any anomalies that may have a high probability of being an artifact of the data acquisition and/or data processing sequence, they will enter a comment in the interpretation file (e.g., noise due to coil bump?). These anomalies will be reviewed a minimum of once per week, and if excessive "no finds" are reported by the intrusive team then only a percentage of these anomalies may be excavated during future intrusive activities.

A master Oasis Montaj database that contains all of the individual data acquisition files for each AOC will be generated and updated each day in order to track the daily progress of the geophysical survey.

The Site Geophysicist will receive and track the data from the field and load the data onto the data management computer. The geophysical data will require computer analysis prior to interpretation. The basic processes for analyzing digitally recorded geophysical data include:

- Geonics software is used to convert the raw EM61-MK2 data to ASCII with units of mV and a corresponding time stamp for each record.
- Assessing daily DGM checks and initial data quality
- Static Background data does not deviate more than 2.0 mV peak to peak or as established at the ITS
- Static Spike data does not deviate by more than +/- 20% from previous spike tests
- Cable shake does not induce spikes into the data
- Personnel signature tests show operator signature does not exceed 2 mV peak to peak or as established at the ITS
- Latency test amplitude response is within +/- 20% and positioning accuracy is within +/- 20 cm (7.9 inches)

- Data positioning quality shows 100% coverage of the survey area with no more than 5% of along-track gaps > 0.183m (0.6 ft) and no across-track gaps > 1m (3.3 feet) except around known obstacles
- DGM data quality demonstrates:
  - Proper time gate response (e.g. Gate 1>gate 2>gate 3>gate 4)
  - Sensor drift is acceptable (e.g. Battery voltage observed in the field remains =>12.0 volts or as determined acceptable at the ITS and drift does not exceed the ability of the leveling filter to correct)
- Positioning of line/station/fiducial data to correct line lengths and conversion to project coordinate system and units.
- Test Item anomaly characteristics (peak response and size) repeatable with allowable variation of +/-25% and position offset <=1m.

The Site Geophysicist or Data Processor will then process and analyze the data to create a target list and target map. All data processing steps will be documented, including gridding parameters, any and all filtering parameters (e.g. drift correction), any and all data corrections (e.g. latency correction), and anomaly selection thresholds and procedures. Each target list will include the Contractor, Target ID#, target Easting and Northing coordinates, the electromagnetic response of the anomaly for all four time gate channels, and any analysis comments or as determined at the ITS . The target data and target maps will then be given to the Unexploded Ordnance Quality Control Specialist (UXOQCS), who will reevaluate the DGM data and anomaly selections. Any additional QC targets will be discussed with the Site Geophysicist who will add them to the target list and load them into the project database. This QC process may also result in removing selected anomalies that fail to meet the anomaly selection criteria as established at the ITS. The UXOQCS will also review the DGM results for the detection of Test Items.

Continued daily data processing and analysis includes the following:

- Data import into processing and analysis software
- Second review of all instrument checks – Flag any/all abnormal sensor or positioning data for possible resurvey (e.g. excessive noise, drift, position jumps or gaps). Provide gap location(s) and direct the DGM team to resurvey
- Assess and apply any corrections for latency, lag, from daily latency test – log corrections
- Drift correct survey data as required – log drift correction variables
- Grid and map corrected data – log all gridding parameters
- Select anomalies on grid data – log anomaly selection methodology
- Review all anomaly selections and add any anomalies not automatically selected. Provide comments on anomalies that do not appear to be MEC-like (e.g. potential utilities).
- Archive all raw, processed data, and final data and data processing documentation
- Post raw, processed, final data, and data processing documentation to the project ftp site

Within 48 hours of completing the geophysical survey, the Site Geophysicist will deliver the Dig List in comma delimited (*.csv) or Microsoft Excel (*.xls) format to the Project UXOQCS.

The raw sensor data files, processed (positioned, corrected, gridded data), and interpreted geophysical data (target dig lists and target maps) will be stored on compact disk (CD) and/or other archive electronic media. Reference information that will be recorded and stored for each survey area includes:

- Site identification (file name and data survey coordinates)
- Acquisition team identification and personnel
- Geophysical equipment used and survey date

This information will be entered from field notes or digital data files acquired by DGM personnel.

The specific parameters used to process the EM61 data may vary; however, the processing parameters and results are documented in digital computer files so that the sequence of events can be reconstructed and analyzed at a later date, if necessary. This level of documentation assists in ensuring that the overall process is repeatable.

4.2.1 Interpretation Summary

The objective of the interpretation is to review AOC's that have been previously cleared by analog methods and evaluate the effectiveness of geophysical surveys at this project site to detect buried metallic items while minimizing the false alarm rate. For this project, the targets are primarily selected based on the anomaly footprint and shape, anomaly intensity for the different data channels, and information derived from previously-excavated targets. The interpreter will utilize information acquired from the ITS test to supplement target selection.

4.3 DATA VALIDATION

The following procedures applied during the processing phase of the project are performed each day in the field to ensure the integrity of the data and reported weekly using Attachment 2, Weekly DGM QC Report. Data that is not of sufficient quality and quantity to meet the project objectives is documented and recollected, if necessary. Procedural checks during the processing of the data include the following:

- Evaluation of the static position and EM61-MK2 data. EM61-MK2 static noise above a pre-defined threshold (as determined at the ITS) is documented and a root cause analysis performed prior to collecting additional data (see section 4.2 above)

- Evaluation of the kinematic geophysical sensor check. These data allow the processor to qualitatively and quantitatively monitor the noise level and repeatability of the data over a "standard" item (e.g. 2" Tow Ball), as well as ensure the data have been positioned correctly using the time-stamp information (i.e., the data contain no time or position shift-also known as "lag")

- Visual examination of the repeatability and of the track path (data are mathematically interpolated so that potential "gaps" present in the data show up as a white color in the color-coded images

- Sample density along transects and grids are statistically assessed. 95 percent of the measurements for transect or grid data require sample distances <= 0.6 ft for each 100 linear feet of data assessed

- Cross-line separations do not exceed 1m (3.3 feet) except around known obstacles.

The guidelines above are for geophysical data where the “background” is a prevalent data characteristic. In areas of high anomaly density (i.e., “cluttered” areas), the above guidelines may not apply.

The data validation measures applied during the interpretation of the data are the following:

- Targets selected interactively by the user are compared to those selected automatically by Oasis Montaj. This process ensures that anomalies that meet a certain criteria for selection are not “missed” by the interpreter and thus included on the digsheet.
- Comparison of the position and EM61-MK2 data to the site features map (e.g., above-ground cultural features) are documented-should be variance in track path
- Interpreted data characteristics are compared to the known responses acquired during the initial test program (e.g., ITS).
- Grid and Transect Test Item anomaly characteristics (peak response and size) are compared to initial Test Item results for allowable variation +/-25%.

4.4 GEOPHYSICAL DATA ARCHIVING

All geophysical data on the data management computer will be archived daily. The entire database and all associate data files will be copied to a writable CD or equivalent digital media (see Attachment 3, Checklist for Data Storage and Transfer). Maintenance of the backup data will be verified by the Site CQC Representative according to the schedule specified in the QC Plan.

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ATTACHMENT 1.
CHECKLIST FOR DATA PROCESSING

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CHECKLIST FOR DATA PROCESSING

			FILENAMES:
Site:	____________	Raw:	____________
Location:	____________	Edited:	____________
Contractor:	____________	Processed:	____________
Sector:	____________	Contour Map:	____________
Grid:	____________	Target List:	____________
Processor(s):	____________	Target Map:	____________

	Y	N	N/A
Preprocessing			
1. Coordinate Conversion:			
Projected Coordinate System :	____	____	____
2. Removal of Drift and Leveling	____	____	____
Record Corrections:			
3. Removal of Magnetometer Heading, if used	____	____	____
Record Corrections:			
4. Lag and Offset	____	____	____
Record Corrections:			
Processing			
5. Initial Gridding	____	____	____
Record Parameters:			
6. Calculation of 3D Analytic Signal	____	____	____
7. Digital Filtering and Enhancement			
❑ Low Pass			
❑ High Pass			
❑ Non Linear	____	____	____
❑ 3x3 Convolution			
❑ Difference			
❑ Other ____________________			
8. Threshold Selection value ____________	____	____	____
9. Anomaly Selection			
Number of targets ____________________	____	____	____

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ATTACHMENT 2.
WEEKLY DGM QC REPORT

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WEEKLY DGM QC REPORT

Project Name:____

Report Week:____

Instrument Latency Test: Metric is no zig-zag or chevron effects visible within +/- 1 data sample

Describe latency correction performed ___________________________________

Document critical latency correction parameter(s)____Attach a representative data image map for each survey day documenting proper latency correction.

Instrument Noise: Metric based on approved ITS results (e.g. Static data < +/- 2.0mV on time gate 1 and dynamic data < +/- 3 mV or as established at the ITS)

Report the weekly summary of all static background noise levels from each static test.

Report the dynamic noise levels for each survey file.

Instrument response test results: Metric +/- 20 % from day to day

Report the weekly summary of all static instrument response tests.

Magnetometer heading correction: If used, 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.

Describe magnetometer heading correction performed ____________________________

Document specific heading correction values_____________________________________

Attach a representative data image map for each survey day documenting proper heading correction.

Data leveling and/or filtering: Metric is leveling and/or filtering utilities do not adversely alter the nature of the original measured response by more than 5% on the time gate used to select anomalies, as demonstrated and established at the ITS. If filter or filter parameters change, the ITS results will need to be rescored and certified.

Describe data leveling and/or filtering used

____

Document critical leveling and/or filtering parameters used____

Attach example of data profile before and after leveling and/or filtering

DGPS Reoccupation accuracy (This test checks that the RTK DGPS base station is set up properly and the equipment is functioning properly): Metric is not to exceed +/- 7.62 cm (0.25 ft) from a known location

Describe the reoccupation point _______________________________________

Record the known location X = _________________, Y ____________________

Summarize the location offsets from each reoccupation test.

Data sampling density: Metric is along-track density will not exceed 0.6 ft for > 5% of data points

Use Oasis QC tools to assess data sampling density.

Check if all data sets pass metric_____________.

Attach QC maps to document any failures.

Across-track line spacing: Metric is line spacing will not exceed 1m (3.3 ft) for > 2% of data points except around known obstacles

Use Oasis QC tools to assess the across-track line spacing for each grid survey.

Check if all data sets pass metric ______________.

Attach QC maps to document any failures.

Anomaly Relocation accuracy (using the rover GPS to relocate an anomaly location reported on the dig list): Metric is not to exceed 7.62 cm (0.25 ft) from dig list location.

Document all failures to meet this requirement.

Refined Anomaly location accuracy (using the reacquisition sensor to optimize the anomaly peak location which may be different from the production survey peak location): Metric is not to exceed 30 cm (1 ft) from anomaly location

Document all discovered location offsets of refined location on Dig List

Include or reference updated dig list with this report.

DGM false negatives: Metric is no false negatives

Document all false negative discoveries

Provide failure ID and photograph (attached to this report)

Provide failure location X = __________________, Y = ______________________

Document corrective action

____

____

Intrusive anomaly resolution: Metric is for all intrusive results resolved with DGM data.

UXOQCS and Project Geophysicist will initial all dig results

Each discrepancy and final resolution will be documented

All false positives identified by the PM are resolved

Final weekly dig list is attached to this report

Site Geophysicist Signature and Date

____

UXOQCS Signature and Date

____

ATTACHMENT 3.

CHECKLIST FOR DATA STORAGE AND TRANSFER

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CHECKLIST FOR DATA STORAGE AND TRANSFER

Project Name: ____________________
Project Location: ____________________
USACE POC: ____________________
Reviewer's Name and Title: ____________________
Date of Review: ____________________

	Y	N	N/A
1. a. Has the transfer medium been approved by Contractor?	____	____	____
b. Are all files in Contractor approved formats?	____	____	____
c. Have all of the following been included in the transfer packet:			
• "Read me" file documenting survey and detailing contents?	____	____	____
• Raw data files?	____	____	____
• Edited data files?	____	____	____
• GPS positioning files (if separate)?	____	____	____
• Completed geophysical maps?	____	____	____
• Prioritized target lists?	____	____	____
• Data File Log / Spreadsheet of Delivered Data Files with Dates Sent?	____	____	____
1. a. Have the required number of copies, per Contractor, been included in the transfer packet?	____	____	____

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PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

MRC N62742-05-D-1868, CTO0010

GEOPHYSICAL PROCESSING

TEAM INFORMATION		
Team:	**Location:**	**Date:**
Team Leader:		
Personnel Present:		
Phase of Inspection (Circle): ***Preparatory (P); Initial (I); Follow-Up (F)***		

CHECKLIST						
Item	**Ref.**	**Inspection Point**	**Yes**	**No**	**N/A**	**Comments**
1	**SOP-3 Workers' Statement**	Have Geophysical Team Members reviewed SOP 3, Geophysical Processing?				*(P)*
2	**MEC SAP, WS#7**	Are Project and Site Geophysicist knowledgeable of their roles and responsibilities?				*(P)*
3	**MEC SAP, WS#8**	Have Project and Site Geophysicist met training requirements?				*(P)*
4	**SOP-3, Sec. 4**	Are geophysical and DGPS survey data files stored on data logger(s) during data acquisition activities collected from each field team and turned over to Site Geophysicist at end of each day?				*(P), (I), (F)*
5	**SOP-3, Sec 4**	After EM61 and DGPS data has been interpreted, are selected target anomaly locations sent to Site Geophysicist and GIS				*(P), (I), (F)*

CHECKLIST						
Item	**Ref.**	**Inspection Point**	**Yes**	**No**	**N/A**	**Comments**
		Technician and added to project data base?				
6	**SOP-3, Attach-1**	Was Data Processing Checklist completed for each data set?				*(P), (I), (F)*
7	**SOP-3, Sec 4**	Is data interpreted using Geosoft Oasis Montaj (or equivalent) software to provide coordinate location information for each target and, as necessary, are color-coded images generated for the grid data/transect data?				*(P), (I), (F)*
8	**SOP-3, Attach-3**	Was Data Storage and Transfer Checklist completed for each data set?				*(P), (I), (F)*
9	**SOP-3**	Is anomaly list data for each survey grid organized by a unique identifier, and does it contain a unique anomaly identifier for each target selection, its x-y coordinate location, and signal intensity value from the EM-61?				*(P), (I), (F)*

FINDINGS	
Item	**Comments**

Conducted By: ____________________ **Reviewed By:** ____________________

STANDARD OPERATING PROCEDURE

FOR

SURFACE CLEARANCE

SOP 4

AREAS OF CONCERN (AOC)

WAIKANE VALLEY IMPACT AREA
KANEOHE, HAWAII

USA ENVIRONMENTAL, INC.

February 2010

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APPROVALS

This standard operating procedure (SOP) contains the procedures and other information that will be needed by USA Environmental, Inc. (USAE) field staff to conduct debris removal to include munitions and explosives of concern (MEC), material potentially presenting an explosive hazard (MPPEH) and surface metallic debris during the MEC activities at AOCs at the Waikane Valley Impact Area, Kaneohe, Hawaii. By their signatures, the undersigned certify that this SOP is approved for implementation at WVIA and will be used to direct debris removal operations.

Robert Nore Project Manager	Date
Thomas Bernitt Program Quality Control Manager	Date
TBD Senior UXO Supervisor	Date

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the clearance described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure the SOP contains current procedures. If a major change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

____________________________________ ______________________

TBD Date

Senior UXO Supervisor

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform in accordance with the SOP, I will stop the process and notify my immediate supervisor.

Worker's Name	Date	Supervisor's Name	Date

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ATTACHMENT 1: MEC DAILY ACTIVITIES CHECKLIST

ATTACHMENT 2: MEC EQUIPMENT CHECKLIST

ATTACHMENT 3: CLEARANCE DATA & MUNITIONS ACCOUNTABILITY LOG

ATTACHMENT 4: PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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1. PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures for surface clearance at sites containing munitions and explosives of concern (MEC), material potentially presenting an explosive hazard (MPPEH), and surface metallic debris in selected work areas during the MEC activities that will be conducted at areas of concern (AOC) at the Waikane Valley Impact Area. These procedures will be conducted in accordance with the Work Plan, the Site Health and Safety Plan (SHSP) and the Explosives Safety Submission (ESS). These procedures are general in nature and may be refined with the concurrence of the Senior UXO Supervisor (SUXOS) to adapt to specific site conditions and circumstances.

2. SCOPE

The procedures described in this SOP are intended to provide a safe environment for personnel performing surface MEC clearance, subsurface MEC investigations, and subsequent geophysical mapping. Specific requirements for vegetation clearance are addressed in SOP 8. Specific requirements for community notification, personnel, training, equipment/material, surface search, and documentation are found in the Work Plan (WP).

3. DAILY PLANNING

3.1 DAILY BRIEFING

At the beginning of each work day, the Senior Unexploded Ordnance Supervisor (SUXOS) or his/her designee will hold a daily briefing in accordance with the requirements of the approved Work Plan. At a minimum, this briefing will include the following:

- Work assignments
- Site Specific Explosive Safety Quantity Distance (ESQD)
- Team separation distances
- Entry and control points
- Review of emergency procedures
- Review of ordnance safety
- Review of communications procedures and equipment
- Review of any site-specific hazards and the measures that will be used to mitigate those hazards
- Review of environmental and archaeological concerns
- Procedures for coordination of intrusive investigation work with personnel performing non-MEC activities.

Other issues will be discussed during the briefing as necessary to support safe and efficient operations. The SUXOS will document the daily briefing in his/her logbook and will obtain the signatures of those attending the briefing on a daily briefing attendance sheet. During the daily briefing, the SUXOS will also assign work sites to each of the UXO teams for intrusive operations. Each UXO Team Leader (TL) UXO Technician III will receive a map and any other data necessary to perform the assigned work. The SUXOS will complete the top portion of the MEC Daily Activities Checklist (Attachment 1) and transfer it to the TL. The top portion of this checklist verifies that the TL has received the necessary information to support his daily activities, information on utilities that may be present in the work area and daily briefing and safety information. The TLs will brief their team on potential hazards in the area where they will be working and will document the briefing on the MEC Daily Activities Checklist, as well as on the Tailgate

Safety Briefing Form in the Accident Prevention Plan (APP). Work assignments, equipment inspections, and other routine daily activities will be documented on the MEC Daily Activities Checklist as well.

3.2 TAILGATE SAFETY MEETING

After arriving at the worksite, the TLs will conduct tailgate safety briefings to cover work assignments, procedures, and hazards specific to that site. The daily briefing may serve as the tailgate briefing if the content covers those additional issues normally reserved for discussion during the tailgate briefing. If the daily briefing is combined with the tailgate meeting, it will include:

- Review of site task assignments for the day
- Review of instrument function test procedures/requirements
- Review of task-specific hazards for that site
- Review of environmental considerations
- Review of any other task- or location-specific information needed to safely complete the assigned daily work.

4. SURFACE CLEARANCE

The primary purposes for this instrument-aided surface clearance are to determine the horizontal extent of MEC within the WVIA AOCs and to rid the site of surface MEC in order to reduce risk to the public. Horizontal extent is considered as defined when the clearance team has cleared for 50 feet in all directions since the last MEC find without finding an additional MEC item.

4.1 PERSONNEL REQUIREMENTS

1. Each intrusive investigation team will be composed of up to 5 members: a TL and any combination of UXOTII/I.
2. Intrusive investigation activities will not be conducted until the required training (both general and site-specific) and proper equipment/vehicle checks have been completed.
3. Intrusive investigation operations will not be initiated until an appropriate Exclusion Zone (EZ) is established based upon the munition with the greatest fragment distance (MGFD) in accordance with the approved Explosives Safety Submission (ESS).
4. A fully supplied Emergency Medical Technician (EMT) will be located just outside the EZ and the appropriate civilian medical personnel will be notified and on-call whenever intrusive operations are conducted.

The SUXOS will be notified of all MEC finds. The following sections discuss various elements of the intrusive process.

4.2 EQUIPMENT/MATERIAL REQUIREMENTS

Each TL will inspect the equipment to be used prior to commencing operations each day to ensure that proper tools and equipment are available. Required field equipment is listed in Attachment 2.

4.3 SURFACE CLEARANCE

When approval to begin the surface clearance is received, the team will enter the work area. The team will form a line abreast, spaced in a manner that permits clear visual examination of the ground surface

(See Section 5.2 of the Work Plan). The team member on one end of the line will act as the guide and navigate a straight path along a marked boundary line. The team will maintain even spacing and alignment with the guide. The team member on the opposite end of the line will mark the border of each swath observed in a manner that provides a clear delineation of the clearance boundary. The SUXOS will determine which technique will be used to mark the clearance boundaries (line, marking flags, cones, and so forth). The marked boundary will guide the next pass as the clearance progresses. All team members will sweep, using the Schonstedt GA-52Cx detector, in small arcs in front of them as they proceed to identify metallic objects on or under the surface. Team members will also visually sweep the area between themselves and adjacent team members for signs of potential past ordnance use. This process will be followed until clearance of all selected areas is complete.

If any potential MEC is located the following actions will be taken:

- The SUXOS will be notified immediately and will inspect the item to confirm the identification.
- Characterization data for MEC will be recorded by the TL on a Clearance Data & Munitions Accountability Log (Attachment 3). The TL will record additional data (weather conditions, issues affecting equipment, schedule, etc.) concerning the clearance operations in the TL field log
- The SUXOS will verify the disposition of MEC items by completing the bottom portion of the Clearance Data & Munitions Accountability Log.

The TL will inform the SUXOS when surface clearance activities are completed. At the end of each day, the TL will complete the remaining items on the Daily Activities Checklist to document successful completion of required activities. The completed checklist will be submitted to the SUXOS for review and, if necessary, correction. The checklist will then be placed in the project files on site.

4.4 ANOMALY REPORTING

When practicable, the TL will record recovered anomaly data on ruggedized Personal Digital Assistants (PDAs), using pull-down menus or on the Clearance Data and Munitions Accountability Log in Attachment1. When a PDA is used, an entry will be made for each anomaly encountered by the dig team members. All fields will be completed by the TL in accordance with the pull-down menu instructions. The TL will turn over the PDA to the Data Manager at the end of the day. The Data Manager will check the data for completeness and accuracy, download the data to the project database, and upload the PDA with the next day's data.

When a PDA is not used, the clearance teams will record anomaly data on the Clearance Data and Munitions Accountability Log. In the field, the UXO team will complete all fields on the top portion of the form. If information is not known or a field is not applicable to an anomaly (e.g., Munitions Mark/Mod), so indicate in the field, and do not leave fields blank. The TL will check each form for completeness and will turn them over to the SUXOS daily. All Clearance Data and Munitions Accountability Logs, digital photographs, and checklists will be turned over to the SUXOS at the end of each working day without exception. It is critical that data not be compromised through loss or improper handling. The SUXOS will identify errors in the forms, have the TL correct the errors, and turn the forms over to the Data Manager for entering into the project database.

A photograph will be taken of MEC and each piece of MPPEH recovered and annotated on the Clearance Data and Munitions Accountability Log to further document the item.

5. DAILY SITE INSPECTION

Following surface clearance operations each day, pin flags, signs, and barricades will be removed as appropriate. Exclusion zone signs can be left in place with approval of the SUXOS. Exclusion zone signs will be left in place if UXO remains in the work area.

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ATTACHMENT 1.
MEC DAILY ACTIVITIES CHECKLIST

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USA Environmental, Inc.

MEC DAILY ACTIVITIES CHECKLIST

Project Information

Project Name: ____________ Date: ______

Project Location: ____________ Team No. ______

Work Area: ____________

SUXOS Checklist items

Name: ____________

Check Items Complete

- ☐ Conduct daily briefing (safety, emergency procedures, munitions information, etc.).
- ☐ Make mandatory notifications prior to conducting field operations (fire, medical support, military offices, etc.).
- ☐ Notify team leader of utilities or other dangers. ____________
- ☐ Assign work area and provide data package.

UXO Team Leader Checklist Items

Name: ____________

Check Items Complete

- ☐ Ensure that all necessary data have been provided by the SUXOS for daily operations.
- ☐ Conduct vehicle inspection.
- ☐ Conduct tailgate safety briefing.
- ☐ Perform equipment inspections and operational tests (record in log book).
- ☐ Verify daily heavy equipment inspection.
- ☐ Identify known utilities.
- ☐ Ensure that work area is secure as required (road closures, exclusion zone set up, etc.).
- ☐ Notify site office of start time for ordnance operations.
- ☐ Ensure that all required data have been recorded (data sheets, log books, photo log, etc.).
- ☐ Ensure that site restoration required is complete.
- ☐ Notify site office of stop time for ordnance operations.

Approvals

SUXOS Signature: ____________ Date: ______

UXOQC Signature: Date:

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ATTACHMENT 2.
MEC EQUIPMENT CHECKLIST

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USA Environmental, Inc.

MEC EQUIPMENT CHECKLIST

Basic Equipment (Required for all UXO work)

✓	Quantity	Item Description
☐	1	Metal detector, Schonstedt (per team member)
☐	1	Emergency eye wash
☐	1	Fire extinguisher
☐	1	First-Aid/trauma kit (equipped for white phosphorus burns)
☐	1	Flashlight
☐	1 pair	Gloves, leather (or other approved work gloves) (per team member)
☐	2	Radios (2-way)
☐	TBD	Pin flags (non-metallic)
☐	3	Shovel, round point
☐	2	Warning signs for exclusion zone
☐	2 rolls	Caution tape
☐	2 rolls	Tape, duct
☐	2 rolls	Tape, plastic
☐	1	Toolbox, general hand tools
☐	1	Trowel
☐	3	Water bottle, 1 liter
☐	--	Field log book and field forms (as appropriate)
☐	1	Water, drinking

Site-Specific Items (Write in items and quantity)

✓	Quantity	Item Description
☐		______
☐		______
☐		______
☐		______

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ATTACHMENT 3.
CLEARANCE DATA & MUNITIONS ACCOUNTABILITY LOG

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CLEARANCE DATA &
MUNITIONS ACCOUNTABILITY LOG

FOR UXO TEAM USE

Site Name:		Team Leader:
Grid or Lane Number:	Work Area:	Date:

Location: X (Lat): ________________ Y (Long): ___________ Location Type (UW or UG):______
Other Location Information: ____
Depth (feet): ___________ Inclination (Degrees): ____________ Orientation (N–S, E-W): _______

TARGET/ANOMALY CHARACTERISTICS

Type of Target/Find: ☐ Surface Find ☐ Mag & Dig Target ☐ Primary Geo Target
☐ Validation (QA/QC) ☐ No Dig

Type of Anomaly: ☐ MPPEH ☐ UXO ☐ MEC ☐ Inert ☐ Practice
☐ Metallic Scrap ☐ No Find* ☐ Rock ☐ Rust Layer ☐ Abandon Dig*
☐ Seed Items Recovered (By location, quantity and seed number):

☐ Misc.*

*Comments:

Diameter/Width:	Length:	Estimated Weight:

DIGITAL PHOTO RECORD

Was photo taken? ☐ Yes ☐ No	Camera No.:	Frame No.:	File Name:

MUNITIONS NOMENCLATURE (If known, record below; record fuze condition and disposition)

Munitions Mark/Mod:	Fuze Mark/Mod: ☐ Nose:____________ ☐ Tail: ☐ Transverse:_______ ☐ Casing:___________	N.E.W. Total:

MUNITIONS CHARACTERISTICS

Munitions Filler: ☐ Explosive ☐ Inert ☐ Propellant ☐ Pyrotechnic ☐ Unknown
☐ Other:

Munitions Category: ☐ Bombs ☐ Grenades ☐ Mortars ☐ Projectiles
☐ Rockets ☐ Small Arms ☐ Land Mines ☐ Sea Mines ☐ Torpedoes
☐ Clusters/Dispensers ☐ Guided Missiles ☐ Pyrotechnic/Flares ☐ Misc. Explosive Devices

CLEARANCE DATA &
MUNITIONS ACCOUNTABILITY LOG

FUZE CHARACTERISTICS

Fuze Location(s) (check all that apply): ☐ Nose ☐ Tail ☐ Transverse ☐Casing	Breaks in Fuze Body? ☐ Yes ☐ No	Fuze Markings:

Fuzing Type(s):
☐ Impact ☐ Influence ☐ Electric ☐ Mech Time (MT)
☐ Hydrostatic ☐ MT Superquick ☐ All-ways Acting ☐ Electric ☐ Point Detonating (PD)
☐ MT Long Delay ☐ Pressure ☐ Piezo-Electric ☐ Base Detonating ☐ Nose MT/Tail Pressure
☐ Powder Train Time Fuze ☐ Nose MT/Tail Impact Inertia ☐Pt-initiating-Base-detonating ☐ Proximity (VT)

Fuze Length:	Fuze Diameter:	Diameter of Fuze Well:

Comments:

MEC STATUS & PHYSICAL CONDITION (Check all that apply)

☐ Armed ☐ Unarmed ☐ Fired ☐ Unfired
☐ Intact ☐ Broken Open ☐ Filler Visible ☐ Soil Staining

FOR SUXOS USE

Disposition: (Clarify Under Remarks) ☐ Transferred ☐ Transported ☐ Left In Place ☐ Destroyed ☐ BIP ☐ Other :______________________		Date:
Client Notifications By:	Signature:	Date
Transferred To:	Signature:	Date:
Destroyed By:	Signature	Date:

Remarks: ____

SUXOS Signature:	Date:

ATTACHMENT 4.
PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST AND QC SURVEILLANCE

MRC N62742-05-D-1868, CTO0010

SURFACE CLEARANCE

TEAM INFORMATION		
Team:	**Location:**	**Date:**
Team Leader:		
Personnel Present:		
Phase of Inspection (Circle): ***Preparatory (P); Initial (I); Follow-Up (F)***		

CHECKLIST						
Item	**Ref.**	**Inspection Point**	**Yes**	**No**	**N/A**	**Comments**
1	**SOP 4 Workers' Statement**	Have all team members reviewed sop 4, surface clearance for WVIA?				*(P)*
2	**MEC SAP WS#7 & 8**	Are all Surface Clearance Team Members qualified in accordance with MEC SAP WS #7 & 8?				*(P), (I), (F)*
3	**SOP-4, Attach. 1**	Has the SUXOS made all mandatory notifications prior to commencing operations?				*(P), (I), (F)*
4	**MEC SAP WS#17, SEC. 17.1**	Was an EZ established by the SUXOS prior to beginning the clearance?				*(P), (I), (F)*
5	**MEC SAP WS#17, Sec. 17.1**	Are Team Separation Distances maintained?				*(P), (I), (F)*
6	**SOP-4, Attach. 2**	Is all required equipment, in accordance with the listed reference, on hand and operational?				*(P), (I), (F)*
7	**APP, SSHP**	Are all team members properly outfitted with the appropriate PPE?				*(P), (I), (F)*
8	**APP**	Have all personnel read and signed all AHAs associated with the surface clearance?				*(P), (I), (F)*
9	**SHSP**	Have onsite and offsite communications channels been established prior to clearance activities commencing?				*(P), (I), (F)*
10	**APP**	Has the Team Leader conducted the Tail Gate Safety Briefing before beginning the surface clearance?				*(P), (I), (F)*
11	**MEC SAP, WS#17, Sec. 17.6**	Are Archaeological Monitors onsite to conduct surveys to protect archaeological features?				*(P), (I), (F)*

CHECKLIST						
Item	**Ref.**	**Inspection Point**	**Yes**	**No**	**N/A**	**Comments**
12	**MEC SAP WS#17, Sec. 17.6**	Are MEC team members maintaining proper spacing to ensure 100% surface clearance coverage of the AOC?				*(P), (I), (F)*
13	**SOP-7**	Are all recovered materials properly inspected, further classified and segregated in accordance with the listed reference?				*(P), (I), (F)*
14	**MEC SAP WS#17, Sec. 17.6**	Are MEC items properly identified, marked and their location recorded for future disposal?				*(P), (I), (F)*
15	**MEC SAP WS#37**	Are all surface seed items accounted for?				*(P), (I), (F)*
16	**SOP-4, Attach. 3**	Is the Team Leader completing all entries on the PDA or his portion of the Clearance Data and Munitions Accountability Log?				*(P), (I), (F)*
17	**SHSP**	Are personal hygiene and decontamination procedures followed?				*(P), (I), (F)*
18	**EPP**	Are Best Management Practices and good house keeping procedures followed to mitigate impacts to the project site?				*(P), (I), (F)*

FINDINGS	
Item	**Comments**

Conducted By: ______________________ **Reviewed By:** ______________________

STANDARD OPERATING PROCEDURE
FOR

INTRUSIVE OPERATIONS

SOP 5

AREAS OF CONCERN (AOC)

WAIKANE VALLEY IMPACT AREA

KANEOHE, HAWAII

USA ENVIRONMENTAL, INC.

February 2010

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APPROVALS

This standard operating procedure (SOP) contains the procedures and other information that will be needed by USA Environmental, Inc. (USAE) field staff to conduct intrusive investigations for materials potentially presenting an explosive hazard (MPPEH) during the MEC activities at AOCs at the Waikane Valley Impact Area. By their signatures, the undersigned certify that this SOP is approved for implementation at WVIA and will be used to direct surface clearance operations.

Robert Nore Project Manager	Date
Thomas Bernitt Program Quality Manager	Date
TBD Senior UXO Supervisor	Date

SUPERVISOR’S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the investigations described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker’s statement for this purpose. I will ensure that the SOP contains current procedures. If a major change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

____ ________________________

TBD Date
Senior UXO Supervisor

WORKER’S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform in accordance with the SOP, I will stop the process and notify my immediate supervisor.

Worker’s Name	Date	Supervisor’s Name	Date

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ATTACHMENT 5. SITE RESTORATION PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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1. PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedural guidance for intrusive investigative clearance of selected target anomalies during the Munitions and Explosives of Concern (MEC) Clearance at Areas of Concern (AOCs) at the WVIA. These procedures will be conducted in accordance with the Work Plan, the Site Health and Safety Plan (SHSP), and Explosives Safety Submission (ESS).

2. SCOPE

This SOP provides guidelines for the intrusive investigation, and documentation of subsurface anomalies that have been selected as targets. Specific requirements and definitions for community notification, personnel, training, and equipment/material, are found in the Work Plan, Environmental Protection Plan/Waste Management Plan (EPP/WMP) and the MEC Quality Assurance Project Plan (QAPP).

3. DAILY PLANNING

3.1 DAILY BRIEFING

At the beginning of each work day, the Senior Unexploded Ordnance Supervisor (SUXOS) or his/her designee will hold a daily briefing in accordance with the requirements of the approved Work Plan. At a minimum, this briefing will include the following:

- Work assignments
- Site Specific Explosive Safety Quantity Distance (ESQD)
- Team separation distances
- Entry and control points
- Review of emergency procedures
- Review of ordnance safety
- Review of communications procedures and equipment
- Review of any site-specific hazards and the measures that will be used to mitigate those hazards
- Review of environmental concerns
- Procedures for coordination of intrusive investigation work with personnel performing non-MEC activities.

Other issues will be discussed during the briefing as necessary to support safe and efficient operations. The SUXOS will document the daily briefing in his/her logbook and will obtain the signatures of those attending the briefing on a daily briefing attendance sheet. During the daily briefing, the SUXOS will also assign work sites to each of the UXO teams for intrusive operations. Each UXO Team Leader (TL) UXO Technician III will receive a map and any other data necessary to perform the assigned work. The SUXOS will complete the top portion of the MEC Daily Activities Checklist (Attachment2) and transfer it to the TL. The top portion of this checklist verifies that the TL has received the necessary information to support his daily activities, information on utilities that may be present in the work area and daily briefing and safety information. The TLs will brief their team on potential hazards in the area where they will be working and will document the briefing on the MEC Daily Activities Checklist, as well as on the Tailgate Safety Briefing Form in the Accident Prevention Plan (APP). Work assignments, equipment inspections, and other routine daily activities will be documented on the MEC Daily Activities Checklist as well.

3.2 TAILGATE SAFETY MEETING

After arriving at the worksite, the TLs will conduct tailgate safety briefings to cover work assignments, procedures, and hazards specific to that site. The daily briefing may serve as the tailgate briefing if the content covers those additional issues normally reserved for discussion during the tailgate briefing. If the daily briefing is combined with the tailgate meeting, it will include:

- Review of site task assignments for the day
- Review of instrument function test procedures/requirements
- Review of task-specific hazards for that site
- Review of environmental considerations
- Review of any other task- or location-specific information needed to safely complete the assigned daily work

4. EQUIPMENT/MATERIAL REQUIREMENTS

Each TL will inspect the equipment to be used prior to commencing operations each day to ensure that proper tools and equipment are available. Required field equipment is listed in Attachment 3.

5. INTRUSIVE INVESTIGATION

Target depth for subsurface clearance is defined in the MEC SAP. Subsurface investigations will be conducted to the depth of detection, but not to exceed the depth to bedrock or the target depth. UXO technicians will detect anomalies using analog equipment. Anomaly data will be recorded on ruggedized Personal Digital Assistants (PDAs), using pull-down menus or on the Clearance Data and Munitions Accountability Log in Attachment1. The following subparagraphs describe the equipment and procedures the individual MEC Teams will use to search the individual grids and to remove MEC and subsurface anomalies.

5.1 PERSONNEL REQUIREMENTS

1. Each intrusive investigation team will be composed of up to 5 members: a TL and any combination of UXOTII/I.
2. Intrusive investigation activities will not be conducted until the required training (both general and site-specific) and proper equipment/vehicle checks have been completed.
3. Intrusive investigation operations will not be initiated until an appropriate Exclusion Zone (EZ) is established based upon the munition with the greatest fragment distance (MGFD) in accordance with the approved Explosives Safety Submission (ESS).
4. A fully supplied Emergency Medical Technician (EMT) will be located just outside the EZ and the appropriate civilian medical personnel will be notified and on-call whenever intrusive operations are conducted.

The SUXOS will be notified of all MEC finds. The following sections discuss various elements of the intrusive process.

5.2 SEARCH LANES

Each grid will be sub-divided into individual search lanes. Individual search lanes will consist of approximately 5-ft-wide paths that run parallel to one boundary of the operating grid. Search lanes will run adjacent to each other and completely cover the entire grid. To lay out the search lanes, the TL will have personnel perform the following:

- Select two opposing boundary lines for installation of the pre-marked lane baselines
- Install one of the pre-marked baselines along each boundary
- Lay out rope or twine between the marks on both baselines to mark individual lane boundaries.

5.3 GRID AND TRANSECT SEARCH

After the establishment of the individual search lanes, the TL will direct personnel to begin searching each lane with the Schonstedt detector. MEC personnel will start at one end of each lane and will move forward toward the opposing baseline. During the forward movement, the individual will move the detector from one side of the lane to the other. Both forward movement and the swing of the detector will be performed at a pace that ensures that the entire lane is searched and that the instrument is able to appropriately respond to subsurface anomalies. When a subsurface anomaly or metallic surface object is encountered, the individual will immediately conduct subsurface investigation of the object. Throughout this operation, the TL will closely monitor individual performance to ensure that these procedures are being performed with due diligence and attention to detail.

The specific intrusive investigation procedures are outlined below:

- An appropriate EZ will be set up for intrusive operations.
- Each anomaly will be investigated by locating the boundaries and excavating gently to one side of the target. A shovel may be used to excavate to within 12 inches of the anomaly. The final 12 inches of cover will be removed using a small trowel or gloved hand.
- Munitions debris will be collected at designated locations within the work area for transport to a storage area pending shipment off island for demilitarization.
- If the anomaly is determined to be MEC, the item will be marked and the SUXOS will be notified to determine disposition of the item.
- If the item is determined by the SUXOS to be MEC and unacceptable to move, it will be left in place and barricaded until it can be safely detonated at the end of the workweek. Notifications to the Project Manager will be made as outlined in the Work Plan.
- If MEC is not intact upon discovery [i.e., exposed high explosive (HE) or filler] this will be noted on the Remedial Investigation Data Sheet. If the munitions item is judged to be safe to transport, it will be placed in a container to prevent further loss of the filler. Any HE or filler that is found on the soil will be marked with a Differential Global Positioning System (DGPS) coordinate or measured from a grid corner and logged in the TL's logbook.
- If an anomaly is located that is not munitions related and it is too large to be removed, it should be left in place. The hole will be inspected by an archaeological monitor and backfilled. The target will be noted as an abandoned dig on the Clearance Data and Munitions Accountability Log. An explanation of the situation will also be provided in the Comment section.
- Once an anomaly is removed, the TL will inspect the excavation both visually and with the all-metals locator to ensure that all anomalies present within the dig depth have been removed. Then an archaeological monitor will inspect the excavation visually to determine if any cultural features have been discovered or disturbed.
- Upon completion of the excavation and the required QC checks, the hole will be backfilled. The hole must be cleared or the reason noted on the Clearance Data and Munitions Accountability Log (e.g., numerous nails spread over a wide area, no find).

The TL will inform the Field Site Office when intrusive activities are completed, and will complete the remaining items on the MEC Daily Activities Checklist (Attachment 2) to document successful completion of required activities. The completed checklist will be submitted to the SUXOS.

5.4 ANOMALY REPORTING

When practicable, the TL will record recovered anomaly data on ruggedized Personal Digital Assistants (PDAs), using pull-down menus or on the Clearance Data and Munitions Accountability Log in Attachment1. When a PDA is used, an entry will be made for each anomaly encountered by the dig team members. All fields will be completed by the TL in accordance with the pull-down menu instructions. The TL will turn over the PDA to the Data Manager at the end of the day. The Data Manager will check the data for completeness and accuracy, download the data to the project database, and upload the PDA with the next day's data.

When a PDA is not used, the dig teams will record anomaly data on the Clearance Data and Munitions Accountability Log. In the field, the UXO team will complete all fields on the top portion of the form. If information is not known or a field is not applicable to an anomaly (e.g., Munitions Mark/Mod), so indicate in the field, and do not leave fields blank. The TL will check each form for completeness and will turn them over to the SUXOS daily. All Clearance Data and Munitions Accountability Logs, digital photographs, and checklists will be turned over to the SUXOS at the end of each working day without exception. It is critical that data not be compromised through loss or improper handling. The SUXOS will identify errors in the forms, have the TL correct the errors, and turn the forms over to the Data Manager for entering into the project database. The location and identifying information for recovered seed items will be recorded on the PDA or on the Clearance Data and Munitions Accountability Log as well.

A photograph will be taken of MEC and each piece of MPPEH recovered and annotated on the Clearance Data and Munitions Accountability Log to further document the item.

5.5 DAILY SITE RESTORATION

Following intrusive sampling each day, pin flags, signs, and barricades will be removed as appropriate. The excavated area will be backfilled after receiving an inspection from the archaeological monitor. Backfill material will consist of native soil from the excavation. Exclusion zone signs can be left in place with approval of the SUXOS. Exclusion zone signs will be left in place if UXO remains in the work area.

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6. REFERENCES

DOD (Department of Defense). 2003. Methodologies for Calculating Primary Fragment Characteristics. DDESB TP 16, Revision 1. December 1.

Navy. 1990. Protection of Personnel and Property. EOD Bulletin 60A 1-1-4, Protection of Personal Property.

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ATTACHMENT 1.
CLEARANCE DATA & MUNITIONS ACCOUNTABILITY LOG

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USA Environmental, Inc.

CLEARANCE DATA &
MUNITIONS ACCOUNTABILITY LOG

FOR UXO TEAM USE

Site Name: | Team Leader:

Grid or Lane Number: | Work Area: | Date:

Location: X (Lat): ________________ Y (Long): ____________ Location Type (UW or UG): ________________

Other Location Information: ____

Depth (feet): ___________ Inclination (Degrees): ____________ Orientation (N–S, E-W): _______

TARGET/ANOMALY CHARACTERISTICS

Type of Target/Find: ☐ Surface Find ☐ Mag & Dig Target ☐ Primary Geo Target ☐ Validation (QA/QC) ☐ No Dig

Type of Anomaly: ☐ MPPEH ☐ UXO ☐ MEC ☐ Inert ☐ Practice
☐ Metallic Scrap ☐ No Find* ☐ Rock ☐ Rust Layer ☐ Abandon Dig*
☐ Seed Items Recovered (By location, quantity and seed number):

☐ Misc.*

*Comments:

Diameter/Width: | Length: | Estimated Weight:

DIGITAL PHOTO RECORD

Was photo taken? ☐ Yes ☐ No | Camera No.: | Frame No.: | File Name:

MUNITIONS NOMENCLATURE (If Known, Record Below and record fuze condition and disposition)

Munitions Mark/Mod: | Fuze Mark/Mod: ☐ Nose:____________ ☐ Tail: ☐ Transverse:_______ ☐ Casing:____________ | N.E.W. Total:

MUNITIONS CHARACTERISTICS

Munitions Filler: ☐ Explosive ☐ Inert ☐ Propellant ☐ Pyrotechnic ☐ Unknown ☐ Other:

Munitions Category: ☐ Depth Charges ☐ Land Mine ☐ Projectiles ☐ Sea Mines
☐ Bombs ☐ Grenades ☐ Misc. Explosive Devices
☐ Pyrotechnics and Flares ☐ Small Arms
☐ Clusters/Dispensers ☐ Guided Missiles ☐ Mortars ☐ Rockets ☐ Torpedoes

FUZE CHARACTERISTICS

Fuze Location(s) (check all that apply):
☐ Nose ☐ Tail ☐ Transverse ☐ Casing

Breaks in Fuze Body?
☐ Yes ☐ No

Fuze Markings:

Fuzing Type(s): ☐ Hydrostatic ☐ MT Long Delay ☐ Powder Train Time Fuze
☐ Nose MT/Tail Impact Inertia
☐ All-ways Acting ☐ Impact ☐ MT Superquick ☐ Pressure ☐ Pt-initiating-Base-detonating
☐ Base Detonating ☐ Influence ☐ Piezo-Electric ☐ Proximity (VT)
☐ Electric ☐ Mech Time (MT) ☐ Point Detonating (PD) ☐ Nose MT/Tail Pressure

Fuze Length: | Fuze Diameter: | Diameter of Fuze Well:

MEC STATUS & PHYSICAL CONDITION (Check all that apply)

☐ Armed ☐ Unarmed ☐ Fired ☐ Unfired
☐ Intact ☐ Broken Open ☐ Filler Visible ☐ Soil Staining

FOR SUXOS USE

Disposition: (Clarify Under Remarks)
☐ Transferred ☐ Transported ☐ Left In Place ☐ Destroyed ☐ BIP
☐ Other : ____________

Date:

Client Notifications By: | Signature: | Date

Transferred To: | Signature: | Date:

Destroyed By: | Signature | Date:

Remarks: ____________

SUXOS Signature: | Date:

ATTACHMENT 2.
MEC DAILY ACTIVITIES CHECKLIST

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MEC DAILY ACTIVITIES CHECKLIST

Project Information

Project Name: ____________ Date: ______

Project Location: ____________ Team No. ______

Work Area: ____________

SUXOS Checklist items

Name: ____________

Check Items Complete

- ☐ Conduct daily briefing (safety, emergency procedures, munitions information, etc.).
- ☐ Make mandatory notifications prior to conducting field operations (fire, medical support, military offices, etc.).
- ☐ Notify team leader of utilities or other dangers. ____________
- ☐ Assign work area and provide data package.

UXO Team Leader Checklist Items

Name: ____________

Check Items Complete

- ☐ Ensure that all necessary data have been provided by the SUXOS for daily operations.
- ☐ Conduct vehicle inspection.
- ☐ Conduct tailgate safety briefing.
- ☐ Perform equipment inspections and operational tests (record in log book).
- ☐ Verify daily heavy equipment inspection.
- ☐ Identify known utilities.
- ☐ Ensure that work area is secure as required (road closures, exclusion zone set up, etc.).
- ☐ Notify site office of start time for ordnance operations.
- ☐ Ensure that all required data have been recorded (data sheets, log books, photo log, etc.).
- ☐ Ensure that site restoration required is complete.
- ☐ Notify site office of stop time for ordnance operations.

Approvals

SUXOS Signature: ____________ Date: ______

Team Leader Signature: Date:

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ATTACHMENT 3.
MEC EQUIPMENT CHECKLIST

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MEC EQUIPMENT CHECKLIST

Basic Equipment (Required for all UXO work)

✓	Quantity	Item Description
☐	1	Air horn
☐	2 rolls	Caution tape
☐	1	Emergency eye wash
☐	1	Fire extinguisher
☐	1	First-Aid/trauma kit (equipped for white phosphorus burns)
☐	1	Flashlight
☐	1 pair	Gloves, leather (or other approved work gloves) (per team member)
☐	2	Radios (2-way)
☐	TBD	Pin flags (non-metallic)
☐	1	Metal detector (Schonstedt GA 52cx)
☐	3	Shovel, round point
☐	2	Warning signs for exclusion zone
☐	2 rolls	Tape, duct
☐	2 rolls	Tape, plastic
☐	1	Toolbox, general hand tools
☐	1	Trowel
☐	3	Water bottle, 1 liter
☐	--	Field log book and field forms (as appropriate)
☐	1	Water, drinking, 5 gal (if required)

Site-Specific Items (Write in items and quantity)

✓	Quantity	Item Description
☐		
☐		
☐		
☐		

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ATTACHMENT 4.
PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST AND QC SURVEILLANCE

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PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST AND QC SURVEILLANCE
MRC N62742-05-D-1868, CTO0010
INTRUSIVE OPERATIONS

TEAM INFORMATION		
Team:	**Location:**	**Date:**
Team Leader:		
Personnel Present:		
Phase of Inspection (Circle): ***Preparatory (P); Initial (I); Follow-Up (F)***		

ITEM	REF.	INSPECTION POINT	YES	NO	N/A	COMMENTS
1	**SOP-5 Workers' Statement**	Have all team members reviewed SOP 5, Intrusive Operations for WVIA?				*(P)*
2	**MEC SAP WS#7 & 8**	Are all Intrusive Team Members qualified in accordance with MEC SAP WS #7 & 8?				*(P), (I), (F)*
3	**SOP-5, Attach. 2**	Has the SUXOS made all mandatory notifications prior to commencing operations?				*(P), (I), (F)*
4	**MEC SAP WS#17, Section 17.1**	Was an EZ established by the SUXOS prior to beginning the intrusive investigation?				*(P), (I), (F)*
5	**MEC SAP WS#17, Sec. 17.1**	Are Team Separation Distances maintained?				*(P), (I), (F)*
6	**SOP-5, Attach. 3**	Is all required equipment, in accordance with the listed reference, on hand and operational				*(P), (I), (F)*
7	**APP, SSHP**	Are all team members properly outfitted with the appropriate PPE?				*(P), (I), (F)*
8	**APP**	Have all personnel read and signed all AHAs associated with the intrusive operations?				*(P), (I), (F)*
9	**SHSP**	Have onsite and offsite communications channels been established prior to clearance activities commencing?				*(P), (I), (F)*
10	**APP**	Has the Team Leader conducted the Tail Gate Safety Briefing before beginning the intrusive investigation?				*(P), (I), (F)*
11	**MEC SAP, WS#17, Sec.**	Are Archaeological Monitors onsite to conduct surveys to protect archaeological				*(P), (I), (F)*

CHECKLIST						
ITEM	**REF.**	**INSPECTION POINT**	**YES**	**NO**	**N/A**	**COMMENTS**
	17.7	features?				
12	**MEC SAP WS#17, Sec. 17.7**	Has each grid been divided into individual 5 ft search lanes?				*(P), (I), (F)*
13	**MEC SAP WS#17, Sec. 17.7**	Are MEC team members swinging the analog detector back and forth to maintain the instrument tip within 6 inches of the ground and complete coverage of the lane?				*(P), (I), (F)*
14	**MEC SAP WS#17, Sec. 17.7**	Are anomalies investigated to the required depths?				*(P), (I), (F)*
15	**MEC SAP WS#17, Sec. 17.7**	Is all subsurface anomalous features removed from the hole prior to moving forward?				*(P), (I), (F)*
16	**SOP-7**	Are all recovered materials properly inspected, further classified and segregated in accordance with the listed reference?				*(P), (I), (F)*
17	**MEC SAP WS#17, Sec. 17.6**	Are MEC items properly identified, marked and their location recorded for future disposal?				*(P), (I), (F)*
18	**SOP-5, Attach. 1**	Is the Team Leader completing all entries on the PDA or his portion of the Clearance Data and Munitions Accountability Log?				*(P), (I), (F)*
19	**SHSP**	Are personal hygiene and decontamination procedures followed?				*(P), (I), (F)*
20	**EPP**	Are Best Management Practices and good house keeping procedures followed to mitigate impacts to the project site?				*(P), (I), (F)*

FINDINGS	
Item	**Comments**

Conducted By: ___________________________ **Reviewed By:** ________________________________

ATTACHMENT 5.
SITE RESTORATION PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

MRC N62742-05-D-1868, CTO0010

SITE RESTORATION

TEAM INFORMATION		
Team:	**Location:**	**Date:**
Team Leader:		
Personnel Present:		
Phase of Inspection (Circle): ***Preparatory (P); Initial (I); Follow-Up (F)***		

CHECKLIST

ITEM	REF.	INSPECTION POINT	YES	NO	N/A	COMMENTS
1	**EPP & WS#17, Sec. 17.9**	Have all team members familiar with the Environmental Protection Plan and WS#17, Sec. 17.9 restoration requirements?				*(P)*
2	**WS#17, Sec. 17.9**	Have all excavation and demolition holes been backfilled with native soils?				*(P), (I), (F)*
3	**WS#17, Sec. 17.9**	Have holes been leveled with the surrounding ground and restored to its prior condition?				*(P), (I), (F)*
4	**MEC SAP WS#17, Section 17.9**	Has sand from used sandbags been recovered or buried in the holes and covered with native soils?				*(P), (I), (F)*
5	**MEC SAP WS#17, Sec. 17.9**	Has all non-munitions scrap been retrieved from target areas?				*(P), (I), (F)*
6	**EPP, Sec. 1.5**	Have all project waste been removed, containerized and properly disposed of in accordance with the EPP?				*(P), (I), (F)*
7	**APP, SSHP**	Has cut vegetation been mulched or cut and dispersed as required by SOP-8?				*(P), (I), (F)*

FINDINGS

Item	Comments

Conducted By: ___________________________ **Reviewed By:** _________________________________

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STANDARD OPERATING PROCEDURE
FOR

EXPLOSIVE DEMOLITION FOR DISPOSAL OF MEC

SOP 6

AREAS OF CONCERN (AOC)

WAIKANE VALLEY IMPACT AREA

KANEOHE, HAWAII

USA ENVIRONMENTAL, INC.

February 2010

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APPROVALS

This standard operating procedure (SOP) contains the procedures and other information that will be needed by USA Environmental, Inc. (USAE) field staff to conduct explosive demolition for the disposal of munitions and explosives of concern (MEC) during the MEC activities at Waikane Valley Impact Area, Kaneohe, Hawaii. By their signatures, the undersigned certify that this SOP is approved for implementation at WVIA and will be used to direct demolition operations.

Robert Nore Project Manager	Date
Thomas Bernitt Program Quality Control Manager	Date
TBD Senior UXO Supervisor	Date

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the activities described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure the SOP contains current procedures. If a major change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

____ ________________________

TBD Date

Senior UXO Supervisor

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform in accordance with the SOP, I will stop the process and notify my immediate supervisor.

Worker's Name	Date	Supervisor's Name	Date

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ATTACHMENT 5. EXPLOSIVE DISPOSAL LOG

ATTACHMENT 6. PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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1. PURPOSE

This document provides basic explosive demolition procedures for the disposal of munitions and explosives of concern (MEC) and material potentially presenting an explosive hazard (MPPEH) found during the MEC surface clearance and subsurface investigation at WVIA. These procedures will be conducted in accordance with the Work Plan, the Site Health and Safety Plan (SHSP), and the Explosives Safety Submission (ESS).

2. SCOPE

This SOP provides the detailed information needed to safely configure, conduct, and clean up demolition shots.

3. PROCEDURES

3.1 NOTIFICATIONS

The Senior Unexploded Ordnance Supervisor (SUXOS) will ensure that the agencies responsible for emergency response are notified as far in advance as possible that disposal activities will be taking place. The notifications should address scheduling, evacuations, road closures, exclusion zones (EZs), and any other required support. Table 1 provides a list of emergency telephone numbers and contacts.

Table 1: Emergency Contact Numbers

Contact	Phone Number
Marine Corps Air Facility Hawaii, Air traffic Control Department	808-257-2694
MCBH EOD Detachment	808-257-7112
FAA Honolulu Control Facility	808-840-6100
Honolulu Police Department District 4, Kaneohe Police Station	808-247-2166
Honolulu Police Department (HPD) Bomb Squad (Office)	808-529-3328
Honolulu Bomb Squad POC Sgt. Carreiro	808-529-3633 808-479-5481
Kaneohe Fire Department	808-235-4417
Navy RPM, Lance Higa	808-472-1473
USAE Project Manager, Robert Nore	256-684-9791
USAE Program Occupational Safety Manager, Cheryl M. Riordan	757-486-8567
USAE Site Superintendent, TBD	Project number - TBD
USAE UXOSO, TBD	Project number - TBD
USAE UXOQCS, TBD	Project number - TBD

3.2 EXCLUSION ZONES, EVACUATIONS, AND ROAD CLOSURES

The initial EZ for WVIA is 1420 ft, based upon the maximum fragmentation range (MFD) for the 3.5 inch rocket, High Explosive Anti-Tank (HEAT), M28. The Demolition Supervisor (DS) will brief all personnel on the evacuation route and rally point should personnel need to evacuate the project site. Figure A-6 in the WP provides the location of the road barriers marking the two road closures for WVIA.

An EZ of 1702 ft, based on the MFD for the contingency MEC item, the 75mm MKI projectile will be incorporated for any items larger than the 3.5 inch rocket and less than or equal to the 75mm projectile. An EZ of 4970 ft (without protective works) will be used for consolidated disposal shot of 50lbs net explosive weight (NEW). For consolidated disposal shots less than 50 lbs NEW but larger than the contingency EZ will be calculated by the Site PM and the SUXOS and submitted to MARCORSYSCOM for approval.

3.3 UXO PERSONNEL REQUIREMENTS

Explosive demolition operations require specific organizational roles and personnel assignments, specifically:

- A SUXOS responsible for planning, directing, and executing all disposal operations.
- A UXOSO/QC to ensure that all work is performed safely and in accordance with the approved site-specific plans.
- A minimum of three UXO Technicians will be used to conduct disposal operations.
- One UXO Technician III will be designated as the DS.
- Two UXO Technicians (level II or I) will assist the DS.
- The UXOSO will act as safety observer; this individual will be located in the safe area and will maintain visual contact with the team down range. He/she will maintain communications with the team, the SUXOS, and USAE Field Office.

3.4 DEMOLITION PROCEDURES REVIEW

Before any disposal operations commence, all technicians assigned to or working with disposal teams will attend a site-specific orientation. The purpose of the orientation will be to review MEC disposal and emergency response procedures. The topics to be covered during the orientation will include, but are not limited to:

- SHSP
- Demolition SOP
- Demolition firing systems and components
- Disposal charge placement
- Explosives transportation
- Site ordnance briefing
- Engineering controls (protective measures for cultural features)
- Type and condition of MEC
- Emergency response equipment
- Emergency procedures

- Team assignments.

3.5 EQUIPMENT/MATERIAL REQUIREMENTS

The DS will be responsible for ensuring that all required equipment and materials are available. The checklists in the attachments to this procedure are examples and should be modified to meet the requirements of each specific job site. As a minimum, the following will be checked prior to commencing disposal operations:

- Demolition equipment (Demolition Equipment Checklist, Attachment 1)
- Health and Safety Equipment (Health and Safety Equipment Checklist, Attachment 2)
- Range/explosive vehicles
- Explosives

Required Documents

The DS will have the approved Work Plan (including all sub-plans) available during clearance operations.

3.6 RANGE VEHICLES

There will be a sufficient number of vehicles to transport all personnel involved in the disposal operation, and each vehicle must have a seat, with a seat belt, for each person.

Vehicles designated to transport explosives will not be used to transport passengers. Explosive vehicles must comply with the provisions of 49 CFR 177.835(e) and (f), and SOP 7.

Vehicles will be parked in a protected area, free of vegetation, facing away from the detonation site. The keys will remain in the ignition at all times.

Vehicles containing explosives will not be left running during loading or unloading of explosives or MEC.

Smoking or flame-producing devices are not permitted within 50 ft of explosive vehicles, and vehicles will not be driven or parked in areas with dry vegetation that could be ignited by the heat generated from catalytic converters.

3.7 WEATHER AND ENVIRONMENTAL CONSIDERATIONS

- Prior to commencing disposal operations the SUXOS or UXOSO will obtain a local weather report.
- Disposal operations will not be conducted if electrical storms are within 10 miles of the disposal site or during severe weather conditions that would impact safety.

3.8 EMERGENCY MEDICAL SUPPORT

- The telephone number of the nearest clinic will be prominently posted at the Field Office.
- The Emergency Medical Technician's (EMT's) location will be briefed and communications established prior to demolition operations commencing.

- Emergency medical personnel will be notified of the location and duration of disposal operations.
- At least two UXO technicians on each demolition team will be trained in first aid and cardiopulmonary resuscitation (CPR).
- A first aid kit, portable eyewash, and bloodborne pathogen kit will be on site at all times. The first aid kit will contain dressings capable of treating traumatic injuries that could result from an explosion.

3.9 FIRE SUPPORT

The telephone number of the Kaneohe Fire Department is located in Table 1 and will be prominently posted in the Field Office.

- The fire department will be notified of the location and duration of disposal operations.
- A 20-lb ABC fire extinguisher and shovels will be on site to fight small fires.
- Evacuate the area if the fire approaches ordnance or explosives.
- Do not fight grass fires in areas where there may be ordnance or kick-outs.

3.10 PERSONAL PROTECTIVE EQUIPMENT

Disposal operations will normally be conducted in Level D personal protective equipment (PPE). This PPE will consist of non-static-producing clothing, gloves, safety glasses, and a sturdy pair of work boots.

4. EXPLOSIVE OPERATIONS

Only qualified UXO technicians will dispose of MEC by open detonation. The following guidelines are provided.

- MEC items found requiring demolition/disposal that are deemed unacceptable to move will be disposed of using the blow-in-place (BIP) technique.
- MEC items that are deemed safe to move may be consolidated in a collection point on the site and detonated en masse.
- Explosive disposal operations will not be conducted without authorization from the SUXOS.
- The DS will directly supervise the transportation and handling of donor explosives.

4.1 INITIATION SEQUENCE

The SUXOS or DS will ensure that the actions taken prior to initiating a demolition shot are completed as follows.

- Ensure all required notifications have been made.
- Set up EZ and post guards at the barricades.
- Visually inspect EZ and surrounding area for unauthorized personnel.
- Announce on the radio that air-horn demolition warnings will follow.
- **Five-minute warning**. The SUXOS/DS will give the five-minute warning on the radio, followed by a 15 second blast on the vehicle horn.

- **One-minute warning**. The SUXOS/DS will give the one-minute warning on the radio, followed by a 15 second blast on the vehicle horn.
- Prior to initiating the shot, the SUXOS/DS will give three loud "*Fire in the Hole!*" warnings and then give the "fire" command on the radio.
- When the area has been cleared (post-blast), the SUXOS will sound a prolonged blast on the vehicle horn.
- The SUXOS/DS will announce on the radio that demolition operations have ceased.

4.2 INITIATION SYSTEMS

The firing system will use the Remote Firing Device (RFD) with electric blasting caps. As a back-up contingency to the RFD, a hand-operated blasting machine will be used to initiate the electrical firing system.

4.3 EXPLOSIVES SYSTEMS CONFIGURATION

4.3.1 PRE-DEMO/DISPOSAL OPERATIONAL BRIEFING

The success of any operation is dependent upon a thorough brief, covering all phases of the task, which is presented to all affected personnel. The SUXOS will brief all personnel involved in range operations in the following areas:

- Type of UXO/MEC being destroyed
- Type, placement, and quantity of demolition material being used
- Method of initiation (electric)
- Means of transporting and packaging MEC
- Route to the disposal site
- Equipment being used (e.g., RFD, galvanometer, blasting machine, firing wire, etc.)
- Misfire procedures
- Post-shot cleanup of range

4.3.2 PREPARING ELECTRIC DETONATORS (CAPS) FOR INITIATION

To prepare electric blasting caps for initiation, the procedures listed below will be followed:

- Prior to making connection with the electric blasting cap, the firing circuit will be continuity tested.
- All parts of the firing circuit will be kept insulated from the ground or other conductors such as bare wires, rails, pipes, or other paths of stray current.
- The shunt will not be removed from the wires until the individual performing the operation has been grounded. Electric blasting caps will be connected to the firing circuit before connection to the main initiation charge.
- Electric blasting caps of different manufacturers or types will not be used in the same system.
- The electric blasting caps will be tested for continuity with a galvanometer at least 50 ft downwind from any explosives prior to connecting them to the firing circuit. After the testing is completed, the lead wires will be short-circuited by twisting the bare ends of the wires together. The wires will remain shunted until ready to connect to the firing circuit.

- The electrical lead wires of electric blasting caps, detonators, or other electro-explosive devices should not be pulled; detonation may occur.
- The legs should be unrolled so that the cap is as far as possible from the operator and pointing away from him.
- The blasting cap will be placed in a hole or behind a barricade before removing the shunt and testing for continuity. The cap should not point toward other personnel or explosives.
- Only authorized and serviceable testing equipment will be used.
- The blasting machine or remote receiver will not be connected to the firing wires until all pre-firing tests have been completed, and all preparations have been made to fire the charge.
- The blasting cap will not be held directly in the hand when un-coiling the leads. The wires will be held approximately 6 inches from the cap. This will minimize injury should the cap explode. The lead wires should be straightened by hand and not thrown, waved, or snapped to loosen the coils.
- The shunt will not be removed from the lead wires of blasting caps except when testing for continuity or actual connection into the firing circuit. The individual removing the shunts should be grounded prior to performing this operation to prevent accumulated static electricity from firing the blasting cap.
- Keep both ends of the firing wires shorted or twisted together except for testing or firing. The blasting caps will not be connected to the firing circuit unless the power end of the firing circuit leads is shorted.

4.3.3 PREPARING EXPLOSIVE CHARGE FOR INITIATION

To prepare the explosive charge for initiation, the procedures listed below will be followed.

- Prepare and place all explosive charges.
- After locating a firing position a safe distance away from the charges, lay out the firing wire if used. (Do not drag firing wire over sand, as this may generate a static charge).
- Test the firing wire by using a blasting galvanometer or test set, after you have ensured the testing equipment is functional, and after the firing wire has been unreeled. Ensure ends are twisted together when not testing.
- Separate firing wire conductors at both ends, and touch those at one end to the galvanometer/test set posts. Needle should not move or lamp glow; if either occurs, the firing wire has a short circuit.
- Twist wires together at one end and touch those at other end to galvanometer/test set posts. This should cause a wide deflection of the needle or the lamp to glow. No movement of the needle indicates a break; a slight movement indicates a point of high resistance that may be caused by a dirty wire, loose wire connections, or wires with several strands broken off at connections.
- Ground yourself. Test the blasting caps by removing the short circuit shunt. Touch one end of the cap lead wire to one post and other cap lead wire to other post of the galvanometer. The galvanometer's needle should deflect at least half scale, if not; the cap is defective and should not be used. When testing is complete, ensure cap lead wires are twisted together.
- Connect blasting cap lead wires to the firing wire or remote receiver after checking it for static electricity.
- Request permission to prime from the SUXOS and, when granted, connect the blasting caps to the demolition shot.
- Depart to firing point.

- Take cover.
- Obtain a head count.
- Ground yourself.
- Test entire circuit by touching free ends of firing wire to test instrument posts (use test procedures for RFD if used). This should cause a wide deflection of needle or lamp to glow. If the firing circuit is defective, shunt wire. Then go down-range and recheck circuits. If a wire is found defective replace the wire, if a splice is found defective disconnect and re splice the wires. If the cap is found defective, replace it. Retest the entire circuit again to make sure that all breaks have been located before attempting to fire.
- Exercise the blasting machine several times before attaching the firing wire. Untwist ends of the firing wire and fasten them to the posts of the blasting machine. If using the RFD, follow the instructions in RFD manual.
- Request permission to fire from the SUXOS.
- When granted permission to fire, make three announcements of "Fire in The Hole" on the radio and three long blasts on the safety vehicle's horn, and then initiate the charge.
- Observe a 5-minute wait time after the detonation. This wait time may be waived by the SUXOS based on observation of the detonation.

4.3.4 POST-DEMOLITION/DISPOSAL PROCEDURES

Do not approach a smoking hole or allow personnel out of the designated safe area until cleared to do so, and follow the procedures listed below.

- After the **"All Clear"** signal, check pit for low orders or kick outs.
- Examine pit, and remove any large fragmentation as needed.
- Backfill hole, as necessary.
- Police all equipment.
- Notify military authorities, fire department, etc., that the operation is complete.

4.3.5 MISFIRE PROCEDURES

A thorough check of all equipment, firing wire, and detonators will prevent most misfires. However, if a misfire does occur, the procedures outlined below will be followed.

Electric Misfires

To prevent electric misfires, one technician will be responsible for all electrical wiring in the circuit. If a misfire does occur, it must be cleared with extreme caution, and the responsible technician will investigate and correct the situation, using the steps outlined below.

- Check firing line and blasting machine connections, and make a second initiation attempt. If using the RFD, follow procedures contained in the RFD Manual.
- If unsuccessful, disconnect and connect to another blasting machine (if available), and attempt to initiate a charge.
- If unsuccessful, commence a 30-minute wait period.

- After the maximum delay predicted for any part of the shot has passed, the designated technician will proceed down range to inspect the firing system, and a safety observer must watch from a protected area.
- Disconnect and shunt the detonator wires, connect a new detonator to the firing circuit, check the replacement detonator for continuity, and prime the charge without disturbing the original detonator.
- Follow normal procedures for effecting initiation of the charge.

Detonating Cord Misfire

USAE uses detonating cord to tie in multiple demolition shots, and to ensure that electric detonators are not buried. In addition to the electrical misfire procedures above, the following will be conducted.

- If there is no problem with the initiating system, wait the prescribed amount of time, and inspect the initiator to the cord connection to ensure it is properly connected. If it was a bad connection, simply attach a new initiator, and follow the appropriate procedures in Paragraph 4.3.3.
- If the initiator detonated and the cord did not, inspect the cord to ensure that it is detonating cord and not time fuze. Also, check to ensure that there is Pentaerythritol Tetranitrate (PETN) in the cord at the connection to the initiator.

It may be necessary to uncover the detonating cord and replace it. This must be accomplished carefully, to ensure that the demolition charge and the MEC item are not disturbed.

4.4 POST-DEMOLITION CLEANUP

An inspection of the disposal site and surrounding area will be conducted after each disposal operation. All munitions debris will be picked up and containerized for future disposition in accordance with approved procedures in the Work Plan.

4.5 RECORDKEEPING

Forms and checklists should be generated and/or modified to meet site-specific requirements. The forms provided in this SOP may be used or alternate forms containing the same information may be used. The SUXOS will make this determination. For disposal operations, the SUXOS or the UXO DS will, as a minimum, complete the following.

- General Safety Precautions (Attachment 3)
- Disposal Operations Checklist (Attachment 4)
- Explosive Disposal Log (Attachment 5)

5. REFERENCES

DoD 6055.9-STD, DOD Ammunition and Explosives Safety Standards

Navy. 1990. *Protection of Personnel and Property.* EOD Bulletin 60A 1-1-4, Protection of Personal Property.

EODB 60A-1-1 31, EOD Disposal Procedures

EP385-1-95A, Basic Safety Concepts and Considerations for Ordnance and Explosives Operations

NAVSEA OP-5, Ammunition and Explosives Ashore

27 CFR 555, Commerce in Explosives

FM 5-250, Explosives and Demolitions

NOSSAINST 8020.15B Explosives Safety Review, Oversight, and Verification of Munitions Responses

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ATTACHMENT 1.
DEMOLITION EQUIPMENT CHECKLIST

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DEMOLITION EQUIPMENT CHECKLIST

Equipment List

Equipment	Quantity	Comments
Explosive Vehicle(s)		
Personnel Vehicle(s)		
Camcorder/Digital Camera		
Air Horn		
Handheld Radios		
Satellite Telephone(s)		
Remote Firing Device		
White XLT all-metals detector		
Shovel, round point, long handle		
Shovel, round point, short handle		
Blasting Machine		
Tape, duct		
Tape, measuring, 50- or 100-meter		
Tape, electricians, plastic		
Toolbox, general hand tools		
Galvanometer		
Firing Wire		
IME-22 container		
Knife		
Initiating explosives		
Donor explosives		
Fire Extinguishers, 10B:C		

Checklist Verification

Disposal Supervisor Signature:	Date:

Attachment 1

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ATTACHMENT 2.
HEALTH AND SAFETY EQUIPMENT CHECKLIST

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HEALTH AND SAFETY EQUIPMENT CHECKLIST

Equipment List

Equipment	Quantity	Comments
Air Horn, emergency		
Burn Blanket		
Burn Kit		
Emergency Eye Wash		
Hand-held Radio and Satellite Phone		
Lightning Detector		
Fire Extinguisher, 20-pound ABC		
Bloodborne Pathogen Kit		
First Aid Kit		
Gloves, leather		
Goggles		
Face Shield(s)		
Fire Retardant Gloves		
Fire Retardant Apron(s)		
Rain Suit(s)		
Safety Vest(s)		
Stretcher		
Water, 5-gal bottle (emergency shower)		
Water, drinking -- 1 liter per person		
Other:		
Other:		

Checklist Verification

Disposal Supervisor Signature:	Date:

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ATTACHMENT 3.
GENERAL SAFETY PRECAUTIONS

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GENERAL SAFETY PRECAUTIONS

1. Carry blasting caps in approved containers and keep them out of the direct rays of the sun. Keep the caps located at least 25 feet from other explosives until they are needed for priming.
2. Do not work with electric blasting caps or other electro-explosive devices while wearing clothing prone to producing static electricity such as nylon, silk, synthetic hair, etc.
3. Do not use explosives or accessory equipment that are obviously deteriorated or damaged. They may cause premature detonation or fail completely.
4. Always point the explosive end of blasting caps, detonators, and explosive devices away from the body during handling.
5. Use only standard blasting caps of at least the equivalent of a commercial No. 8 blasting cap.
6. Use electric blasting caps of the same manufacturer for each demolition shot involving more than one cap.
7. Do not use improvised methods for initiating blasting caps.
8. Do not bury blasting caps. Use detonating cord to transmit the explosive wave from the blasting caps, on the surface, to a buried/tamped explosive charge. Buried blasting caps are subject to unobserved pressures and movement, which could lead to premature firing or misfires.
9. Test electric-blasting caps for continuity at least 50 feet from any other explosives prior to connecting them to the firing circuit. Upon completion of testing, the lead wires will be shunted by twisting the bare ends of the wires together. The wires will remain shunted until ready to be connected to the firing circuit.
10. In the event of a misfire when disposing of explosives by detonation, do not approach the disposal site for at least 30 minutes after the expected detonation time, when firing electrically.
11. Items with lugs, strong backs, tail-booms, base plates, etc., should be oriented away from personnel locations.
12. Consideration should be given to tamping the UXO to control fragments, if the situation warrants. Fragments will be minimized not only to protect personnel but also property, such as buildings, trees, etc.
13. Avoid inhaling the smoke, dust, or fumes of burning pyrotechnic or incendiary materials. The smoke, dust and fumes from many of these materials are irritating and/or toxic if inhaled.

14. Do not use water on incendiary fires. Water may induce a violent reaction or be completely ineffective, depending on the mixture.
15. Anticipate a high order detonation when burning pyrotechnic or incendiary-loaded MEC. Safety measures for personnel and property must be based upon this possibility.
16. Inert ordnance will not be disposed of, or sold for scrap, until the internal fillers have been exposed and unconfined. Heat generated during a reclamation operation can cause the inert filler, moisture, or air to expand and burst the sealed casings. Venting or exposure may be accomplished in any way necessary to preclude rupture due to pressure from being confined. All requirements of the UXO Procedure for the Management and Disposition of Material Potentially Presenting an Explosive Hazard (MPPEH) will be met prior to releasing any inert ordnance material.
17. Maintain minimum safe distances between electromagnetic-radiating sources and electro-explosive devices (IAW EODB/TM-TO 60A-1-1-12).
18. Do not conduct blasting or demolition operations during an electrical, dust, sand, or snowstorm severe enough to produce atmospheric static electrical charges, or when such a storm is nearby (within 10 miles). Under such conditions, all operations will be suspended or terminated, cap and lead wires shunted, and personnel removed from the demolition area. Demolition operations will also be terminated if visibility becomes less than 600 feet.
19. Loose initiating explosives: lead azide, mercury fulminate, lead styphnate, and tetracene. These explosives manifest extreme sensitivity to friction, heat, and impact. Extra precautions are required when handling these types of explosives. Keep initiating explosives in a water-wet condition at all times until ready for final preparation for detonation. Sensitivity of these explosives is greatly increased when dry.
20. Exercise extreme care when handling and preparing high explosives for detonation. They are subject to detonation by heat, shock, or friction.
21. Do not pack bomb fuze wells with explosives unless it can be positively confirmed that the fuze well does not contain any fuze components.
22. Photo flash bombs must be handled with the same care as black powder-filled munitions.
23. MEC containing white phosphorous will not be detonated into the ground. White phosphorous munitions will be counter-charged on the bottom centerline (CCBC) when possible.
24. A search of the detonation site, after the demo operation, will be conducted to assure complete disposal was accomplished.
25. Do not abandon any explosives.
26. Do not leave explosives, empty cartridges, boxes, liners or other materials used in the packing of explosives lying around where children, unauthorized persons or livestock can get at them.

27. Do not allow any wood, paper or other materials used in packing explosives to be burned in a stove, fireplace, or other confined space, or be re-used for any other purpose. Such materials will be destroyed by burning at an isolated location out of doors, with no one allowed within 100 feet of the burning operation.
28. Do not fight fires involving explosive material. Evacuate all personnel to a safe location and secure the area.
29. Know and observe federal, state, and local laws/regulations that apply to the transportation, storage, and use of explosives.
30. Do not permit metal, except approved metal truck bodies, to contact explosive containers.
31. Do not transport metal, flammable, or corrosive substances with explosives.
32. Do not allow smoking, or the presence of unauthorized personnel, in vehicles transporting explosives.
33. Carefully load and unload explosives from vehicles. Never throw or drop explosives from the vehicle.
34. Assure the load is blocked and braced to prevent it from movement and displacement.
35. Do not drive vehicles containing explosives over public highways until all permits and certifications have been obtained from the state enforcement agencies.
36. All routes must be approved in writing prior to transporting explosive materials over public highways.
37. Licensed commercial carriers will conduct the shipment of explosive materials over public highways unless USAE UXO personnel have been specifically licensed and certified to make the shipment.
38. Never leave a vehicle that is loaded with explosives unattended.
39. Do not store blasting caps, detonators, or other items containing initiating explosives in the same box, container, or magazine with other explosives.
40. Store explosive materials in military or ATFE-approved magazines only. Ensure the magazines used for the storage comply with quantity distance requirements, for the class of explosive material they contain. Reference documents include: OP-5, TM 9-1300-206, AMCR 385-100, ATFE - Explosives Law and Regulation, ATFE P 5400.7, and 49 CFR.
41. Do not store spark-producing metal/tools in an explosive magazine.
42. Do not permit smoking, matches, or any source of fire or flame within 100 feet of an explosive magazine.
43. Do not allow leaves, grass, brush, or debris to accumulate within 50 feet of an explosive magazine.
44. Do not permit the discharge of firearms within 300 feet of an explosive magazine.
45. Do not use any alkaline material such as lye, washing soda, or soap to remove TNT exudate. Alkaline materials will react with TNT to render it more sensitive.

46. Do not permit smoking, matches, or other sources of fire or flame within 100 feet of an area in which explosives are being handled.
47. Do not expose explosives or devices containing explosive to prolonged exposure to direct sun light. Such exposure can increase sensitivity and deterioration.
48. Ensure all unused explosives are returned to their proper containers and the container closed after use.
49. Do not carry explosives or explosive components in pockets or on the body.
50. Do not strike, tamper with, or attempt to remove or investigate the contents of an electric/non-electric blasting cap, detonator, or other explosive initiating device. A detonation may occur.
51. Do not pull on the electrical lead wires of electric blasting caps, detonators, or their electro-explosive devices. A detonation may occur.
52. Do not attempt to remove an unfired or misfired primer or blasting cap from a base coupling. There is a high risk of an explosion.
53. Do not allow unauthorized or unnecessary personnel to be present when explosives are being handled.
54. Do not use pull rings or safety pins to lift or handle explosive devices.

ATTACHMENT 4.
DISPOSAL OPERATIONS CHECKLIST

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	DISPOSAL CHECKLIST	OPERATIONS
FUNCTION	**DATE/TIME**	**SIGNATURE**
SUXOS		
Assign Disposal Team		
Brief Disposal Team Review emergency procedures Discuss MEC/MPPEH to be disposed Describe Disposal procedures and method		
Verify that all MEC items logged for demolition are accounted for		
Inspect Range/Exclusion Zone upon completion of operations		
Disposal Supervisor		
Assign demolition task to team members		
Verify Not Later Than (NLT) disposal time includes wait time for misfire procedures		
Verify roads are closed		
Verify Exclusion Zone boundaries in place		
Complete health and safety and equipment checklists		
Ensure Field Office has completed the verification checklist Responsible activity Medical Facility Fire Department Security/Police Department		
Disposal Supervisor tailgate safety brief: Designate emergency vehicles Designate emergency evacuation route Review emergency response procedures		
Verify daily equipment inspection		
Verify detonators are separated from explosives		
Verify area has been evacuated		
Verify engineering controls are correct		
Notify Field Office that operations are commencing		
Start disposal activities		
Inspect shot after designated wait time		
Collect all metal fragments for later disposal		
QC check performed		
Stop disposal activities		
QA check (if required)		
USAE notify upon completion: Notify Client Responsible Activity Medical Facility Fire Department Security/Police Department		
Complete MEC/MPPEH Accountability Log		
Demobilize		
Record data in Explosive Disposal Log		
Demolition Supervisor signature:		Date:
Attachment 4		

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ATTACHMENT 5.
EXPLOSIVE DISPOSAL LOG

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	EXPLOSIVE DISPOSAL LOG		
Project Information			
Project Name:		Start Time:	
Project Location:		Stop Time:	
MEC Disposed of This Date (List items and quantity of each item)			
Donor Explosive Used (List types and quantity)			
Remarks			
Approval			
Demolition Supervisor:		Date:	
Attachment 5			

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ATTACHMENT 6.
PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST AND QC SURVEILLANCE

MRC N62742-05-D-1868, CTO0010

MEC DISPOSAL

TEAM INFORMATION		
Team:	**Location:**	**Date:**
Team Leader:		
Personnel Present:		
Phase of Inspection (Circle): ***Preparatory (P); Initial (I); Follow-Up (F)***		

CHECKLIST						
ITEM	**REF.**	**INSPECTION POINT**	**YES**	**NO**	**N/A**	**COMMENTS**
1	**SOP-6 Workers' Statement**	Have all Disposal Team Members reviewed SOP 6, Explosive Demolition for WVIA?				*(P)*
2	**MEC SAP WS#7&8**	Are all Disposal Team Members qualified in accordance with MEC SAP WS #7&8?				*(P), (I), (F)*
3	**SOP-6, Sec. 3.1**	Has the SUXOS made all mandatory notifications prior to disposal activities?				*(P), (I), (F)*
4	**SOP-6, Sec. 3.2**	Was an EZ established by the SUXOS prior to beginning the clearance?				*(P), (I), (F)*
5	**SOP-6, Sec. 3.3**	Are the appropriate personnel assigned to the disposal operation?				*(P), (I), (F)*
6	**SOP-6, Sec. 3.4**	Have all assigned personnel attended the site-specific for reviewing the MEC disposal and emergency response procedures in the listed reference?				*(P), (I), (F)*
7	**SOP-6, Attach. 3**	Have all assigned personnel read or been briefed on the General Safety Precautions in Attachment 3?				*(P), (I), (F)*
8	**SOP-6, Attach. 1&2**	Are the required demolition equipment and health and safety equipment on-hand and in operating condition?				*(P), (I), (F)*
9	**SOP-6, Sec. 3.7**	Was the local weather forecast obtained prior to commencing disposal operations?				*(P), (I), (F)*
10	**SOP-6, Sections 3.8&3.9**	Have Emergency Medical and Fire Support been notified of disposal operations and standing by?				*(P), (I), (F)*
11	**SHSP**	Have onsite and offsite communications channels been established prior to clearance activities commencing?				*(P), (I), (F)*
12	**SOP-6, Attach. 4**	Have SUXOS and Disposal Supervisor completed the disposal operations checklist in Attachment 4?				*(P), (I), (F)*
13	**SOP-6, Sec. 4**	Have items identified for disposal been inventoried and accounted for?				*(P), (I), (F)*
14	**SOP-6, Sec.**	Have the donor explosives been properly				

CHECKLIST						
ITEM	**REF.**	**INSPECTION POINT**	**YES**	**NO**	**N/A**	**COMMENTS**
	3.6	accounted for and isolated from flame-producing devices and dry vegetation?				
15	**APP**	Has the Team Leader conducted the Tail Gate Safety Briefing before beginning the intrusive investigation?				*(P), (I), (F)*
16	**MEC SAP, WS#17, Sec. 17.7**	Were Archaeological Monitors onsite to conduct surveys to protect archaeological features?				*(P), (I), (F)*
17	**SOP-6, Sec 4.3**	Were explosive charges assembled in accordance with SOP Section 4.3?				*(P), (I), (F)*
18	**SOP-6, Sec. 4.1**	Were the proper pre-ignition warnings conducted in accordance with SOP Section 4.1?				*(P), (I), (F)*
19	**SOP-6, Sec. 4.3.5**	Were misfire procedures followed in the event a misfire occurred?				*(I), (F)*
20	**SOP-6, Sec. 4.4**	Was a post demolition inspection and cleanup of the disposal area conducted?				*(I), (F)*
21	**SOP-6, Sec. 4.5**	Were all SOP checklist completed and logbook entries made?				*(P), (I), (F)*

FINDINGS	
Item	**Comments**

Conducted By: ___________________________ **Reviewed By:** ________________________________

STANDARD OPERATING PROCEDURE
FOR

MPPEH MANAGEMENT

SOP 7

USA ENVIRONMENTAL, INC.

February 2010

APPROVALS

This standard operating procedure (SOP) contains the procedures and other information that will be needed by USA Environmental, Inc. (USAE) field staff to conduct debris removal to include munitions and explosives of concern (MEC), material potentially presenting an explosive hazard (MPPEH) and surface metallic debris during the MEC activities at the Waikane Valley Impact Area (WVIA). By their signatures, the undersigned certify that this SOP is approved for implementation at the (WVIA) and will be used to direct debris removal operations.

____ ________________________

Date

Project Manager

____ ________________________

Date

Corporate/Program Quality Control Manager

____ ________________________

TBD Date

Senior UXO Supervisor

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the clearance described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure the SOP contains current procedures. If a major change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

_______________________________________ ____________________

TBD Date

Senior UXO Supervisor

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform in accordance with the SOP, I will stop the process and notify my immediate supervisor.

Worker's Name	Date	Supervisor's Name	Date

TABLE OF CONTENTS

1. PURPOSE **3**

2. SCOPE **3**

3. INSPECTION PROCESS **3**

4. MDAS CONTAINERIZATION **7**

5. MDAS CERTIFICATION AND VERIFICATION **7**

6. CHAIN OF CUSTODY **7**

ATTACHMENT 1. DD Form 1348-1A Examples

ATTACHMENT 2. MATERIAL INSPECTION AND RELEASE FORM

ATTACHMENT 3. NON-HAZARDOUS WASTE (CONTAINER LABEL)

ATTACHMENT 4. PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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1. PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide procedures that ensure that interior and exterior of all recovered MPPEH is inspected to determine what explosive hazard, if any exist, requiring further treatment before shipping off site for final treatment. These procedures are general in nature and may be refined with the concurrence of the Senior UXO Supervisor (SUXOS) to adapt to specific site conditions and circumstances.

2. SCOPE

These procedures will be conducted in accordance with the Work Plan, the Site Health and Safety Plan (SHSP) and the Explosives Safety Submission (ESS). This SOP provides the MPPEH management process that describes the inspection, storage, certification/verification procedures, and the chain of custody requirements for materials documented as safe (MDAS) slated for shipment to an authorized recycler. Specific requirements for personnel, training, equipment/material, surface search, and documentation are found in the Work Plan (WP).

3. INSPECTION PROCESS

All recovered MPPEH items will undergo a 100% inspection and an independent 100% re-inspection to determine and document whether it is safe (MDAS) or whether it is known to have or is suspected of having an explosive hazard [material documented as an explosive hazard (MDEH)]. The sequence of events in the inspection process is summarized in Figure 1. A Material Inspection and Release Form (Attachment 2) will be completed to document the two 100% inspections performed on all recovered materials.

A UXOTII (a UXOTI can tentatively identify items, however, a UXOTII or UXOTIII must confirm the identification) will perform a 100% inspection of each item as it is recovered and determine:

- If the item is MDAS, requiring no additional treatment prior to containerizing for off-site shipment
- If the item is MDEH (including unexpended small arms cartridges) that requires additional treatment (demilitarization, i.e. detonation or venting to expose a dangerous filler)
- If item is range related debris that may require draining fluids or removal of visible liquid hazardous, toxic or radiological waste (HTRW) materials.

A UXOTIII will:

- Conduct a 100% re-inspection of all recovered items to determine the proper classification as MDAS, MDEH or an item containing other dangerous fillers or HTRW constituents.
- Supervise the segregation of items by category to ensure no co-mingling of MDAS and MDEH or HTRW items.

The UXOQCS will:

- Conduct daily audits of UXO Teams performing the MPPEH inspection process and will conduct and document random sampling of all processed MDAS, MDEH and HTRW items to ensure no co-mingling occurs.

The UXOSO will:

- Ensure specific procedures and responsibilities for processing MPPEH for certification as MDAS MDEH or range-related debris outlined in the WP and this SOP are being followed
- Ensure all procedures for processing are being performed safely and consistent with applicable regulations.

The SUXOS will:

- Perform random checks to determine that the munitions debris and range-related debris are free from explosive hazards necessary to complete the appropriate Requisition and Turn-in Document, DD Form 1348-1A (see Attachment 1)
- Ensure that a DD Form 1348-1A is completed for all MDAS and range-related debris to be transferred for final disposition
- Ensure the WP, QC Plan and this SOP outline the procedures and responsibilities for processing MPPEH for final disposition as MDAS or range-related debris
- Certify all MDAS and range-related debris with one of the following statements as applicable –

    - "This certifies that the material listed has been 100 percent properly inspected and, to the best of our knowledge and belief, are free of explosive hazards, engine fluid, illuminating dials and other visible liquid HTRW materials."[1]
    - "This certifies and verifies that the material listed has been 100 percent inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials."[2]

- Ensure that inspected debris is secured in sealed and labeled containers.

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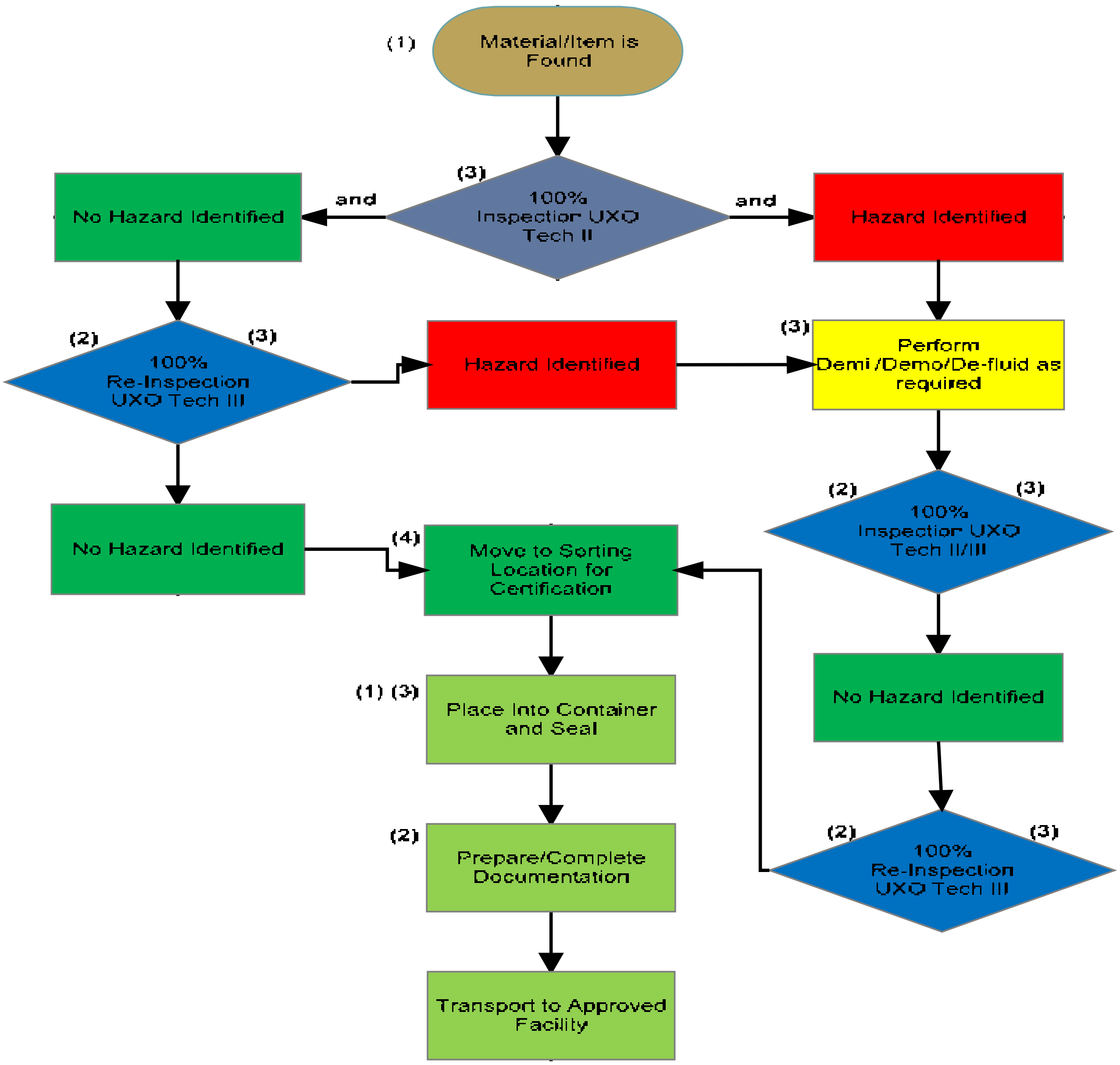
[1] This statement will be used on any ranges where range-related debris is being processed along with munitions debris

[2] This statement will be used for properties where only munitions debris is being processed

Figure 1: MPPEH INSPECTION PROCESS



Notes:

During performance of the steps within the MPPEH Inspection Process, Notes 1 - 4 below are utilized to ensure supervision and compliance requirements are met

(1) The UXOQCS will conduct daily audits of procedures used by UXO teams for MPPEH processing

(2) The UXOQCS will perform random sampling of recovered material/items and documents for accuracy/completeness

(3) The UXOSO will observe procedures to ensure compliance with the approved plans and safety measures

(4) The SUXOS will perform random checks to satisfy that the munitions debris and range-related debris is free from explosive hazards necessary to complete DD Form 1348-1A

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4. MDAS CONTAINERIZATION

MDAS is placed in closed containers that will be sequentially number and:

- Closed in such a manner that the applied seal will be broken if the container is opened
- Clearly labeled with USA Environmental, Inc., the installation/project name, the sequence number (e.g. 0001), and the container's unique seal identification, see Attachment 3 for detailed requirements for completing the label

5. MDAS CERTIFICATION AND VERIFICATION

The SUXOS will certify the MDAS by preparing and signing the DD Form 1348-1A for all shipments of recovered materials as discussed in Section 3 above. The designated government representative will verify the shipments if available, otherwise the shipment verification is delegated to the UXOQCS.

The 1348-1A will contain the appropriate statement as mentioned in Section 3 and prepared to provide the required information as shown in Attachment 1.

6. MAINTAINING THE CHAIN OF CUSTODY

The chain of custody must remain intact until the MDAS is released from DOD control that is received and signed for by the qualified receiver to further manage and process the material in accordance with DOD Instruction 4140.62. The qualified receiver will:

- Receive the unopened labeled containers
- Review and concur with the supporting documents
- Sign the 1348-1A and provide on company letterhead stating the contents of the sealed containers will not be sold, traded or otherwise given to another party prior to smelting and are only identifiable by their basic contents
- Send the supporting documentation and notification to USA that the MDAS in the sealed containers has been smelted and is only identifiable by its basic content.

If the chain of custody is broken at any time during shipment, the contents of the affected container will revert to MPPEH and will require a second 100% inspection and a 100% re-inspection, be documented as certified and verified as MDAS by qualified USA personnel.

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ATTACHMENT 1.
DD FORM 1348-1A EXAMPLES

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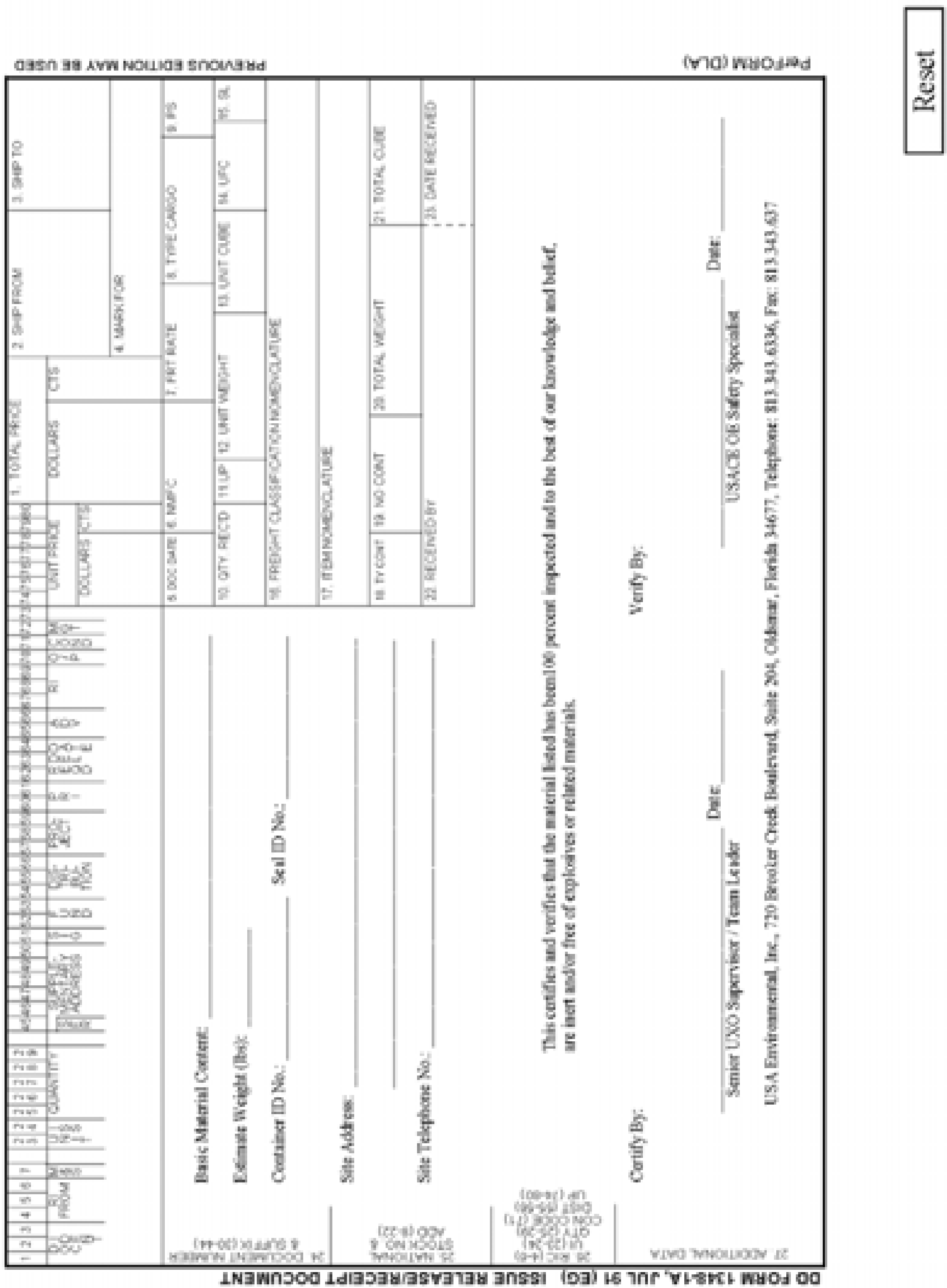

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

PREVIOUS EDITION MAY BE USED

1. TOTAL PRICE — DOLLARS — CTS
UNIT PRICE — DOLLARS — CTS
2. SHIP FROM
3. SHIP TO
4. MARK FOR
5. DOC DATE
6. NMFC
7. FRT RATE
8. TYPE CARGO
9. PS
10. QTY. REC'D
11. UP
12. UNIT WEIGHT
13. UNIT CUBE
14. UFC
15. SL
16. FREIGHT CLASSIFICATION NOMENCLATURE
17. ITEM NOMENCLATURE
18. TY CONT
19. NO CONT
20. TOTAL WEIGHT
21. TOTAL CUBE
22. RECEIVED BY
23. DATE RECEIVED
24. DOCUMENT NUMBER & SUFFIX (30-44)
25. NATIONAL STOCK NO. & ADD (8-22)
26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)
27. ADDITIONAL DATA

Basic Material Content: ____________________

Estimate Weight (lbs): __________

Container ID No.: __________ Seal ID No.: __________

Site Address: ____________________

____

Site Telephone No.: ____________________

This certifies and verifies that the material listed has been100 percent inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials.

Certify By:

Verify By:

______________________ Date: __________
Senior UXO Supervisor / Team Leader

______________________ Date: __________
USACE OE Safety Specialist

USA Environmental, Inc., 720 Brooker Creek Boulevard, Suite 204, Oldsmar, Florida 34677, Telephone: 813.343.6336, Fax: 813.343.637

PerFORM (DLA)

Reset

DD Form 1348-1A: FOR USE FOR PROPERTIES WHERE ONLY MUNITIONS DEBRIS IS BEING PROCESSED

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Reset

DD FORM 1348-1A, JUL 91 (EG) ISSUE RELEASE/RECEIPT DOCUMENT

PREVIOUS EDITION MAY BE USED

1. TOTAL PRICE	2. SHIP FROM	3. SHIP TO
UNIT PRICE (DOLLARS, CTS) / DOLLARS, CTS	4. MARK FOR	

5. DOC DATE	6. NMFC	7. FRT RATE	8. TYPE CARGO	9. PS
10. QTY. REC'D	11. UP	12. UNIT WEIGHT	13. UNIT CUBE	14. UFC	15. SL

16. FREIGHT CLASSIFICATION NOMENCLATURE

17. ITEM NOMENCLATURE

18. TY CONT	19. NO CONT	20. TOTAL WEIGHT	21. TOTAL CUBE
22. RECEIVED BY			23. DATE RECEIVED

24. DOCUMENT NUMBER & SUFFIX (30-44)

25. NATIONAL STOCK NO. & ADD (8-22)

26. RIC (4-6) UI (23-24) QTY (25-29) CON CODE (71) DIST (55-56) UP (74-80)

27. ADDITIONAL DATA

Basic Material Content: ______________________

Estimate Weight (lbs): __________

Container ID No.: ____________ Seal ID No.: ____________

Site Address: ______________________

____

Site Telephone No.: ______________________

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

Certify By: Verify By:

______________________ Date: __________
Senior UXO Supervisor / Team Leader

______________________ Date: __________
USACE OE Safety Specialist

USA Environmental, Inc., 720 Brooker Creek Boulevard, Suite 204, Oldsmar, Florida 34677, Telephone: 813.343.6336, Fax: 813.343.637

PerFORM (DLA)

DD Form 1348-1A: FOR USE WHERE RANGE-RELATED DEBRIS IS PROCESSED WITH MUNITIONS DEBRIS

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ATTACHMENT 2.
MATERIAL INSPECTION AND RELEASE FORM

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USA 100% MATERIAL INSPECTION AND RELEASE FORM

Project:							Document Date:
Location:							Document Number:
Container Number:	Seal #:	Initials 1st:	Initials 2nd:	Reseal #:	Initials 1st:	Initials 2nd:	Comments:
The above listed containers have received two separate 100% inspections to ensure proper classification of material.							
A copy of this form is to accompany the listed containers to final disposition and be retained for a period of 3 years.							
This form is used to document the inspections performed by two UXO qualified personnel, one of whom must be a Technician III or higher.							
This form is not to be used in place of other required documents for the transportation and/or accountibility of material.							
Name of First 100% Inspector:					Title:		Date:
Name of Second 100% Re-Inspector:					Title:		Date:

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ATTACHMENT 3.
NON-HAZARDOUS WASTE (CONTAINER LABEL)

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NON-HAZARDOUS WASTE

Solid Waste Excluded From Regulation Under 40 CFR 261.4 (b)

SHIPPER: USA Environmental, Inc.

PROJECT ADDRESS / LOCATION:

CITY, STATE, ZIP:

PROJECT CONTACT AND TELEPHONE NUMBER:

USACE IDENTIFIER / INSTALLATION NAME OR CONTRACT #:

UNIQUE CONTAINER # (i.e., 0001 of 0001): of

UNIQUE SEAL IDENTIFICATION #:

Date:	Seal Number:	1st Initials:	2nd Initials:	Comments:

☐ DD Form 1348-1A ☐ 100% Material Inspection and Release Form

NOTE: See DD Form 1348-1A For Additional Information.
Check box(s) if DD Form 1348-1A and/or the 100% Inspection Form will accompany this shipment.

CONTACT INFORMATION: USA Environmental, Inc.
720 Brooker Creek Blvd., Suite 204
Oldsmar, FL. 34677
(813) 343-6336

CONTAINER LABEL

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ATTACHMENT 4.
PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

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PREPARATORY, INITIAL, FOLLOW-UP CHECKLIST and QC SURVEILLANCE

MRC N62742-05-D-1868, CTO0010

MPPEH MANAGEMENT

TEAM INFORMATION		
Team:	**Location:**	**Date:**
Team Leader:		
Personnel Present:		
Phase of Inspection (Circle): ***Preparatory (P); Initial (I); Follow-Up (F)***		

ITEM	REF.	INSPECTION POINT	YES	NO	N/A	COMMENTS
1	**SOPs 7 Workers' Statement**	Have all Surface Clearance and Intrusive Team Members reviewed SOP 7, MPPEH Management for WVIA?				*(P)*
2	**MEC SAP WS#7&8**	Are all Surface Clearance, Intrusive and Disposal Team Members qualified in accordance with MEC SAP WS #7&8?				*(P), (I), (F)*
3	**SOP-7, Sec. 3**	Has all recovered MPPEH undergone a 100% inspection and an independent 100% re-inspection?				*(P), (I), (F)*
4	**DOP-7, Sec. 3**	Was Material Inspection Release Form completed to document the two independent 100% inspections?				*(P), (I), (F)*
5	**SOP-7, Sec. 3**	Were inspected items properly classified as MDAS or MDEH, as verified through random sampling by the UXOQCS?				*(P), (I), (F)*
6	**SOP-7, Sec. 3**	Has the Team Leader ensured no co-mingling of MDAS and MDEH?				*(P), (I), (F)*
7	**SOP-7, Sec. 3**	Has the SUXOS conducted random checks of munitions debris and range related debris to ensure there are no explosives hazards?				*(P), (I), (F)*
8	**SOP-7, Sec. 3**	Has all MDEH been demil/demo/de-fluid as necessary to remove any hazards?				*(P), (I), (F)*
9	**SOP-7, Sec. 3**	Once demil/demo/de-fluid as required, were materials 100% inspected and 100% re-inspected in order to classify as MDAS?				*(P), (I), (F)*
10	**SOP-7, Sec. 3**	Has all properly inspected debris been secured in sequentially number, labeled containers?				*(P), (I), (F)*

CHECKLIST						
ITEM	**REF.**	**INSPECTION POINT**	**YES**	**NO**	**N/A**	**COMMENTS**
11	**SOP-7, Sec. 3 & Attach. 3**	Are container labels properly filled-out?				*(P), (I), (F)*
12	**SOP-7, Sec. 3 & Attach. 1**	Is the appropriate statement used to certify that materials are free from explosives or other hazards incorporated on the DD Form 1348-1A for each container?				*(P), (I), (F)*

FINDINGS	
Item	**Comments**

Conducted By: ___________________________ **Reviewed By:** _________________________________

APPENDIX C. MC SAMPLING AND ANALYSIS PLAN

This appendix contains the Sampling and Analysis Plan for Munitions Constituents at the Waikane Valley Impact Area.

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DRAFT FINAL
Remedial Investigation
Munitions Constituents
Sampling Analysis Plan
Munitions Response Sites

WAIKANE VALLEY IMPACT AREA
KANEOHE, HAWAII

8 February 2010

Commander
Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Contract Number N62742-05-D-1868, CTO 0010

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Worksheet #1: Title and Approval Page

Draft Final
Munitions Constituents
Sampling and Analysis Plan
Munitions Response Sites
February 2010

Remedial Investigation
Waikane Valley Impact Area
Kaneohe, Oahu, Hawaii

Prepared for:

Department of the Navy
Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860-3134

Prepared by:

USA Environmental, Inc.
720 Brooker Creek Blvd. Ste. 204
Oldsmar, FL 34677

Wil Chee - Planning, Inc.
1018 Palm Drive
Honolulu, HI 96814

Prepared under:
Munitions Response Contract for Worldwide Sites
Contract Number N62742-05-D-1868, CTO 0010

USA Environmental, Inc.
QA Manager:

____
Robert D. Crownover Date

USA Environmental, Inc.
CTO Manager:

____
Bob Nore Date

NAVFAC Hawaii
RPM:

____
Lance Higa Date

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EXECUTIVE SUMMARY

This munitions constituents (MC) sampling and analysis plan (SAP) has been prepared to support the remedial investigation (RI) of the Waikane Valley Impact Area (WVIA) located near Kaneohe, Oahu, Hawaii. USA Environmental, Inc. (USAE) prepared this SAP in collaboration with Wil Chee - Planning, Inc. (WCP) for Naval Facilities Engineering Command Pacific (NAVFAC PAC) under Contract N62742-05-D-1868.

The RI consists of a surface clearance and subsurface investigation to determine the extent of hazard associated with munitions and explosives of concern (MEC) and munitions constituents. This document represents the MC SAP whereas all MEC related issues are discussed in a separate document (MEC SAP). Based on the result from previous investigations, five areas of concern (AOCs) have been identified within WVIA for further investigation. The area along Waikane Stream has been identified as an AOC because it is located down-gradient of the other four AOCs and has a potential for MC to have migrated from upgradient target areas. The remaining four AOCs represent four target areas, which are being investigated because of the presence of MEC and the potential presence of MC.

The information collected during this RI will aid in the selection of areas to be further evaluated, remediated, or approved for no further action by the WVIA Project Team (Project Team) if it is agreed these areas do not pose an unacceptable level of risk to human health and/or the environment. The Project Team working on the RI effort currently comprises individuals from the Navy, the U.S. Environmental Protection Agency (EPA) Region IX, and Department of Health, State of Hawaii (HDOH). The Project Team participants vary depending on the nature of the issues at hand, and other stakeholders may be (or may have been in the past) active in the team process or meetings.

This SAP, including the standard operating procedures (SOPs) located at the end of the SAP, is one of the planning documents for WVIA contained in the work plan. The SAP documents the project organization, specific procedures for the execution of the work, quality control, and the assessment and oversight planning that will help ensure the quality of the remediation. Other plans incorporated in the work plan (and referenced accordingly in the MC SAP) include the accident prevention plan (APP), the environmental protection plan (EPP), as well as the MEC SAP and the quality control plan (QCP).

Note: The project team determined during the draft MC SAP review process that the Environmental Action Levels (EALs) of the Hawaii Department of Health as the regulatory oversight of this project will be used as project action levels unless a level for a certain chemical of potential concern (COPC) does not exist, in which case the EPA Region IX residential Regional Screening Levels (RSLs) will be utilized.

The project team also identified during the review process that copper and lead are the primary COPCs for the multi-incremental surface soil and discrete subsurface soil investigation whereas blow-in-place samples will also be analyzed for nitroaromatics/nitroamines and additional heavy metals. Composite sediment samples will be analyzed for copper and lead as well as cobalt, mercury and RDX, the COPCs that were identified in surface water samples from Waikane Stream in a U.S. Army Corps of Engineers study (USACE 2009).

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Attachment B Sampling SOPs

Attachment C Analytical SOPs and Laboratory QC Limits

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Attachment E Scoping Meeting Minutes

Attachment F NAVFAC Pacific Standard Operating Procedures

Attachment G References

FIGURES (SEE ATTACHMENT A)

Figure 1: Site Map

Figure 2: Decision Units & Estimated MEC / MD Surface Density Map

Figure 3: Decision Units & Estimated Subsurface Anomaly Density Map

ACRONYMS AND ABBREVIATIONS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
AL	action level
AOC	areas of concern
BERA	baseline ecological risk assessment
bgs	below ground surface
BIP	blow-in-place
CA	corrective action
CAS	chemical abstract services
CD	compact disc
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	contract laboratory program
COC	chain of custody
COPC	chemical of potential concern
CSM	conceptual site model
CTO	contract task order
DERP-FUDS	Defense Environment Restoration Program – Formerly Used Defense Sites
DoD	Department of Defense, United States
HDOH	Department of Health, State of Hawaii
DON	Department of the Navy, United States
DQA	data quality assessment
DQI	data quality indicator
DU	decision unit
EAL	environmental action level
EDD	electronic data deliverable
ELAP	Environmental Laboratory Accreditation Program, Department of Defense
EOD	explosive ordnance disposal
EPA	Environmental Protection Agency, United States
ER	environmental restoration
FS	feasibility study
HEER	Hazard Evaluation and Emergency Response
ID	identification
IDW	investigation-derived waste
LCS	laboratory control samples
LDC	Laboratory Data Consultants, Inc.
MC	munitions constituents
MCB HAWAII	Marine Corps Base Hawaii, Kaneohe Bay
MEC	munitions and explosives of concern
MD	munitions debris
MDL	method detection limit
mg/kg	milligram(s) per kilogram
MI	multi-incremental

mm	millimeter
MPC	measurement performance criteria
MRS	munitions response site
MS	matrix spike
MSD	matrix spike duplicate
NAVFAC	Naval Facilities Engineering Command
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	no further action
NAVFAC ESC	Naval Facilities Engineering Service Center
NOAA	National Oceanic and Atmospheric Administration
PPE	personal protective equipment
PQL	laboratory practical quantitation limit
PQOs	project quality objectives
PT	proficiency testing
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control
QL	quantitation limit
QSM	DoD Quality Systems Manual
RDX	cyclo-1,3,5-trimethylene-2,4,6-trinitramine
RI	remedial investigation
RL	reporting limit
RPD	relative percent difference
RPM	remedial project manager
SAP	sampling and analysis plan
SCP	Hawaii State Contingency Plan
SI	site inspection
SIM	selected ion monitoring
SOP	standard operating procedure
SW	solid waste
TBD	to be determined
U.S.	United States
USAE	USA Environmental, Inc.
USACE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USMC	United States Marine Corps
UFP-SAP	Uniform Federal Policy for Sampling and Analysis Plan
UXO	unexploded ordnance
WCP	Wil Chee - Planning, Inc.
WP	work plan

Worksheet #2: Sampling and Analysis Plan Identifying Information

Site Name / Number:	Remedial Investigation, Waikane Valley Impact Area, Kaneohe, Oahu, Hawaii
Operable Unit:	
Contractor Name:	USA Environmental, Inc. (USAE)
Contract Number:	N62742-05-D-1868
Contract Title:	Munitions Response Contract for Worldwide Sites
Work Assignment Number (optional):	CTO 0010

1. This sampling and analysis plan (SAP) was prepared in accordance with the following:

Title	Date
Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP) (DoD 2005)	March 2005
US Environmental Protection Agency (EPA) Guidance for Quality Assurance Project plans, EPA QA/G-5, QAMS (EPA 2002a)	December 2002
Project Procedures Manual, U.S. Navy Environmental Restoration (ER) Program, NAVFAC Pacific (Department of the Navy [DON] 2007)	February 2007
EPA Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4) (EPA 2006b)	February 2006
State of Hawaii Department of Health, Environmental Hazards at Sites with Contaminated Soil and Groundwater (Department of Health [HDOH] 2009)	March 2009
Department of Defense Quality Systems Manual (DoD QSM) for Environmental Laboratories Version 4.1 (Department of Defense [DoD] 2009)	April 2009
Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP)	October 2009

2. Identify regulatory program:

Primary:	Defense Environmental Restoration Program in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Sections 104 and 121; Executive Order 12580; and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).
Secondary:	None

3. This SAP is a project-specific SAP.

4. List dates of sessions that were held (meeting minutes are located in Attachment E):

Scoping Session	Date
In-Progress Draft RI SAP (Worksheets #10, #11, #15, and #17) Clarification Meeting with State of Hawaii Department of Health	April 20, 2009

5. List dates and titles of any documents written for previous site work that are relevant to the current investigation.

Title	Date
Site Investigation Report Pali Training Camp, Heeia Combat Training Area, and Waikane Training Area, Oahu, Hawaii (USACE 2009)	September 2009
Ecological Risk Evaluation for Waikane Valley Training Area (CH2M Hill 2009)	June 2009
Site Inspection Work Plan, Munitions Response Sites, Waikane Valley Training Area, Kaneohe, Hawaii (USAE 2008)	May 2008
Environmental Background Analysis of Metals in Soil at Navy Oahu Facilities (DON 2006)	June 2006
Atlas of Hawaii, Third Edition (Juvik and Juvik, 1998)	1998
Preliminary Range Assessment Report and Archive Search Report for Waikane Valley Training Area. (United States Army Corps of Engineers [USACE] 1998)	1998
DERP-FUDS Inventory Project Report, Waikane Training Area, Island of Oahu, Hawaii, Site No. H09H1035400 (USACE 1996)	May 1996
Geohydrology of the Island of Oahu, Hawaii (Hunt, 1996)	1996
Rainfall Atlas of Hawaii (Giambelluca, 1996)	1996
Geological Map and Guide of the Island of Oahu, Hawaii (Stearns 1985)	1985
Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai (United States Department of Agriculture [USDA] 1972)	1972
Geology and Groundwater Resources of the Honolulu-Pearl Harbor Area (Wentworth 1951)	1951

6. List organizational partners (stakeholders) and identify the connection with lead organization:

Organization Partners / Stakeholders	Role
Naval Facilities Engineering Command (NAVFAC), Pacific	Lead Agency and Land Users
Marine Corps Base (MCB) Hawaii, Kaneohe	Land Users
HDOH	State Regulatory Agency
USAE	Navy Contractor
Wil Chee - Planning, Inc. (WCP)	Sub Contractor
Curtis & Tompkins, Ltd.	Laboratory Subcontractor
Laboratory Data Consultants, Inc. (LDC)	Data validation subcontractor

7. Lead organization: NAVFAC, Pacific

8. If any required SAP elements and required information are not applicable to the project or are provided elsewhere, then note the omitted SAP elements and provide an explanation for their exclusion below:

All SAP elements are applicable to the project.

Worksheet #3: Distribution List

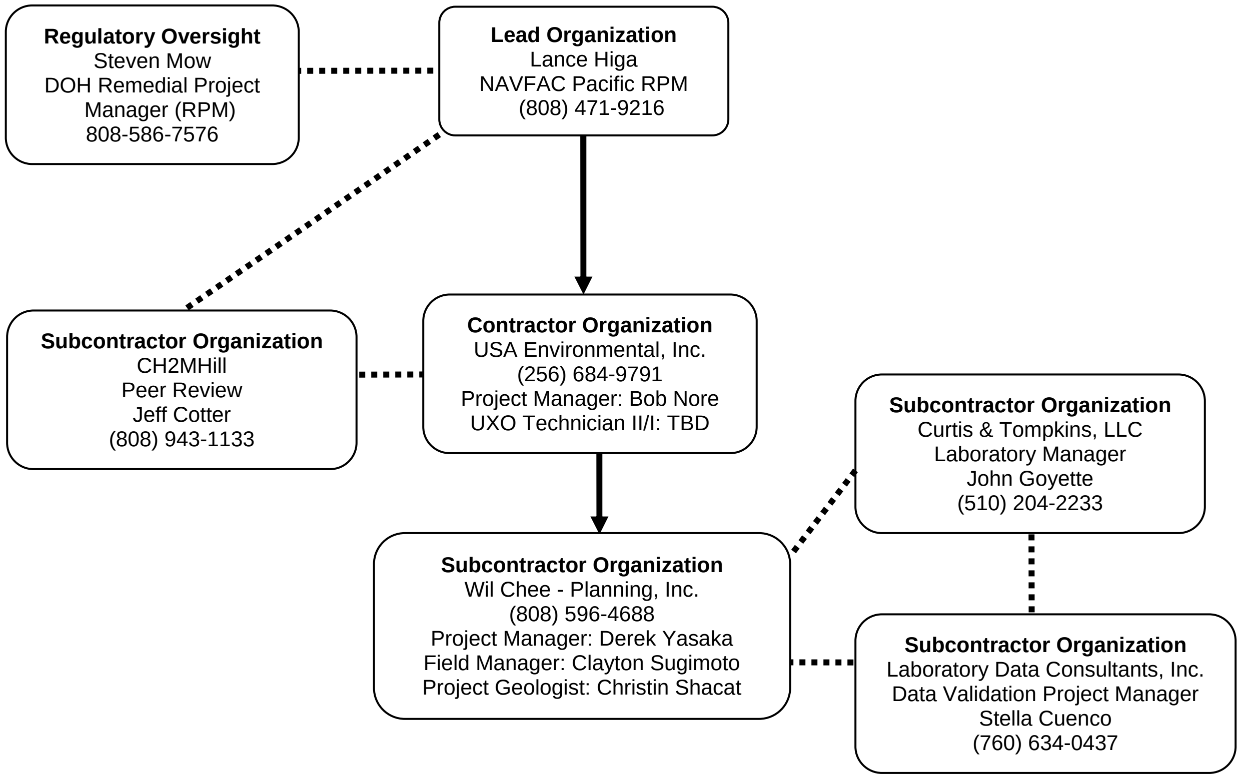
Work Plan Recipients	Title	Organization	Telephone Number	E-mail Address or Mailing Address
Lance Higa	Remedial Project Manager	NAVFAC Pacific	(808) 471-9216	lance.higa@navy.mil
Randall Hu	Environmental Manager MCB Hawaii	MCB Hawaii Environmental Compliance and Protection Department	(808) 257-6920 Ext. 232	randall.hu@usmc.mil
Steven Mow	Remedial Project Manager	State of Hawaii Department of Health, Hazard Evaluation and Emergency Response Branch	(808) 586-4251	steven.mow@doh.hawaii.gov
Bob Nore	Project Manager	USA Environmental, Inc.	(256) 684-9791	bnore@usatampa.com
Derek Yasaka	Senior Manager	Wil Chee - Planning, Inc.	(808) 596-4688	wcpderek@lava.net
Jeff Newman	Assistant Field Supervisor	US Dept of Interior, Fish and Wildlife Service	(808) 792-9442	jeff_newman@fws.gov
John Goyette	Quality Control Chemist	Curtis & Tompkins, Ltd.	(510) 486-0900	goyette@ctberk.com
Stella Cuenco	Data Validator	Laboratory Data Consultants, Inc.	(760) 634-0437	erauto@lab-data.com
Laurie Sullivan	Regional Resources Coordinator	Office of Response and Restoration, National Oceanographic and Atmospheric Agency (NOAA)	(707) 575-6077	laurie.sullivan@noaa.gov

Worksheet #4: Project Personnel Sign-Off Sheet

Project Personnel	Organization, Title	Telephone Number (Optional)	Signature / E-mail Receipt	SAP Section Reviewed	Date SAP Read
Lance Higa	NAVFAC Pacific, Remedial Project Manager	(808) 471-9216			
Bob Nore	USA Environmental, Inc., Project Manager	(256) 684-9791			
Robert D. Crownover	USA Environmental, Inc., Quality Assurance (QA) Manager	(831) 343-6336			
Teresa Rottero	USA Environmental, Inc., QA Chemist	(831) 343-6336			
to be determined (TBD)	USA Environmental, Inc., Unexploded Ordnance (UXO) II / I Technician	(813) 343-6420			
John Goyette	Curtis & Tompkins, Ltd., Quality Control (QC) Chemist	(510) 486-0900			
Stella Cuenco	Laboratory Data Consultants, Inc., Data Validator	(760) 634-0437			
Derek Yasaka	Wil Chee - Planning, Inc., Senior Manager	(808) 596-4688			
Christin Shacat	Wil Chee - Planning, Inc., Project Geologist	(808) 596-4688			

Worksheet #5: Project Organizational Chart

Lines of Authority ———— Lines of Communication ··········



Worksheet #6: Communication Pathways

The communication pathways for the SAP are shown below.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure
Manages all phases of work	Project Manager, USA Environmental, Inc.	Bob Nore	(256) 684-9791	Bob Nore acts as the liaison between the subcontractors and the NAVFAC Pacific RPM as well as MCB HAWAII, Kaneohe
Major modifications to work plan	Project Manager, USA Environmental, Inc.	Bob Nore	(256) 684-9791	Bob Nore is responsible for all SAP changes as the project manager and SAP preparer. Bob Nore will notify the NAVFAC Pacific RPM of any work plan modifications within 24 hours.
Analytical data results	Quality Control Chemist, Curtis & Tompkins, Ltd.	John Goyette	(510) 486-0900	Analytical data will be sent to WCP within 21 days. The analytical data will also be sent directly to Laboratory Data Consultants for data validation.
Validated analytical data	Data Validator, Laboratory Data Consultants	Stella Cuenco	(760) 634-0437	Laboratory Data Consultants will forward the results of the data validation to WCP for review within 21 days. WCP will forward the results to the Project Manager.
Release of analytical data	NAVFAC Pacific RPM	Lance Higa	(808) 471-9216	No analytical data will be released until data validation is complete and NAVFAC Pacific has approved the release.
Notification of delays or changes in field work, or issues affecting sample integrity	Field Manager and Project Geologist, Wil Chee - Planning, Inc.	Clayton Sugimoto, Christin Shacat	(808) 596-4688	Clayton Sugimoto and Christin Shacat act as the liaisons between the subcontractors and USA Environmental, Inc. Bob Nore will be notified of delays, changes, or any other issue affecting field work or sampling within 24 hours.
Laboratory data quality issues	Quality Control Chemist, Curtis & Tompkins, Ltd.	John Goyette	(510) 486-0900	All QA / QC issues with project field samples will be reported to WCP, within 24 hours via telephone or email.
Data Usability	Report Author	Bob Nore	(256) 684-9791	Responsible for determining and managing the usability of the data obtained from the RI.

Worksheet #7: Personnel Responsibilities and Qualifications Table

Project-specific responsibilities are provided in the following table.

Name	Title	Organizational Affiliation	Responsibilities
Bob Nore	Project Manager	USA Environmental, Inc.	Coordinates with Navy, provides overall project direction and guidance, prepares and maintains final work plan, identifies project problems or non-conformance and initiates corrective actions, and responsible for data usability.
Derek Yasaka	Senior Manager	Wil Chee - Planning, Inc.	Coordinates with the CTO Manager, responsible for preparation of the SAP, procurement of laboratory and data validators, field sampling, and preparation of portions of the RI Report.
Clayton Sugimoto	Field Manager	Wil Chee - Planning, Inc.	Directs and oversees field sampling efforts, maintains field logbook, identifies problems or non-conformance.
Christin Shacat	Project Geologist	Wil Chee - Planning, Inc.	Assist in SAP preparation. Perform onsite QC and assist in data analysis for RI/FS Report preparation
TBD	UXO II / I Technician	USA Environmental, Inc.,	Provide UXO avoidance oversight during soil and sediment sampling activities.
John Goyette	Quality Control Chemist	Curtis & Tompkins, Ltd.	Oversees chemical analysis of soil samples and generation of results. The analytical laboratory will have a current ELAP accreditation.
Stella Cuenco	Project Manager	Laboratory Data Consultants, Inc.	Oversees analytical data validation, generates NEDD / NIRIS deliverables

Worksheet #8: Special Personnel Training Requirements Table

Project Function	Specialized Training By Title or Description of Course	Training Provider	Training Date	Personnel / Groups Receiving Training	Personnel Titles / Organizational Affiliation	Location of Training Records / Certificates
	Please refer to MEC SAP					

Worksheet #9: Project Scoping Session Participants Sheet

Project Name:	Remedial Investigation / Feasibility Study of Waikane Valley Impact Area, Munitions Response Program Site	Site Name:	Waikane Valley Impact Area
Projected Date(s) of Sampling:	Refer to Worksheet #16	Site Location:	Kaneohe, Hawaii
Project Manager:	Richard Hosokawa, RPM, NAVFAC Pacific		
Date of Session:	April 20, 2009 at NAVFAC Pacific Headquarters building at Makalapa Drive, Pearl Harbor, Hawaii		
Scoping Session Purpose:	Coordinate w/ stakeholders, develop problem statement, formulate project quality objectives, basis for worksheets # 10, 11, 15 & 17		

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Wray Kakugawa	Remedial Project Manager	NAVFAC Pacific	(808) 472-1421	wray.kakugawa@navy.mil	Remedial Project Manager
Richard Hosokawa	Supervisory Environmental Engineer	NAVFAC Pacific	(808) 471-9216	richard.hosokawa@navy.mil	Supervisory Environmental Engineer
Kris Saboda	Quality Assurance Manager	NAVFAC Pacific	(808) 472-1409	kristine.saboda@navy.mil	QAPP Quality Assurance Manager
Karen Desilets	Archaeologist	NAVFAC Pacific	(808) 472-1445	karen.desilets@navy.mil	Cultural Response Support
Randall Hu	Environmental Manager MCB HAWAII	MCB Hawaii Kaneohe	(808) 257-6920 x81	randall.hu@usmc.mil	Activity/Installation Point of Contact
Maria Reyes	Remedial Project Manager	DOH-HEER Office	(808) 586-7576	maria.reyes@doh.hawaii.gov	Project Manager
Steven Mow	Remedial Project Manager	DOH-HEER Office	(808) 586-4251	steven.mow@doh.hawaii.gov	Project Manager
Bob Nore	Project Manager	USA Environmental, Inc.	(256) 684-9791	bnore@usatampa.com	Project Manager
Daniel Miller	Senior UXO Specialist	USA Environmental, Inc.	(813) 695-4389	dmiller@usatampa.com	Site Manager
Clayton Sugimoto	Environmental Scientist	Wil Chee - Planning, Inc.	(808) 596-4688	csugimoto@wcphawaii.com	Field Technician
Christin Shacat	Geologist	Wil Chee - Planning, Inc.	(808) 596-4688	cshacat@wcphawaii.com	Geologist
Ning Li	Geologist	CH2M Hill	(808) 440-0211	nli@ch2m.com	Project Manger

DOH-HEER State of Hawaii Department of Health Hazard Evaluation and Emergency Response

Comments/Decisions (see Attachment E for Scoping Meeting Minutes): Project area to be called "Waikane Valley Impact Area"; Proposed helicopter airlifting of heavy munitions debris (MD); No objection to the use of weed whackers and chainsaws for vegetation clearance; blow-in-place (BIP) procedures; Discussion on confirmation sampling of detonation points; Recommendation to proceed further if munitions and explosives of concern (MEC) is found at boundaries of decision units (DUs); Limitations of detection-equipment due to vertical slopes; MD management;

Archaeological monitors need to be on hand before and after excavations; Problem statement development; Pictorial conceptual site model (CSM) requested by Navy; Use of EPA regional screening levels; Discussion on Multi-Incremental (MI) Sampling in stream sediment samples.

Action Items: CH2M Hill will develop a baseline ecological risk assessment (BERA) to investigate risk to ecological receptors, if no risk to ecological receptors is determined, the 400 milligram per kilogram (mg/kg) threshold (human health) will be used instead of the 200 mg/kg level (terrestrial ecotoxicity); Wil Chee - Planning, Inc. (WCP) to draft SAP worksheets; Inquire regarding feasibility of MI sampling in Stream DUs versus discrete or composite; Determination if BIP confirmation sampling is necessary.

Consensus Decisions: Only analyzing for copper and lead in soil due to the Project Action Level (PAL) exceedance during the site inspection (SI); Instead of water samples from Waikane Stream, sediment samples will be taken as recommended by Department of Health (HDOH); Decision on shape, number, and location of DUs, three replicate samples for MI sampling (surface samples); Subsurface samples (one at 2 and one at 3 feet) to be taken at one location in each DU; All MEC related topics to be removed from this munitions constituents (MC) SAP and to be covered in MEC SAP (MEC meeting dates were established).

Worksheet #10: Problem Definition

10.1 INTRODUCTION

The purpose of this RI is to determine the nature and extent of the hazard/threat presented by MEC and MC contamination at WVIA. Sufficient data will be provided in order to perform an explosives safety hazard assessment, human health/ecological risk assessment, and evaluate proposed MEC/MC remedial alternatives for those AOCs within the MRS that have been determined to present an unacceptable risk to human health and/or the environment. Integrating the development of the RI is important to ensure that data obtained in the RI is appropriate to evaluate likely remedial alternatives during the feasibility study (FS). This document represents the MC SAP whereas all MEC related issues are discussed in a separate document (MEC SAP).

The location and pertinent features of WVIA are depicted in Figure 1. WVIA MRS consists of 187-acres and is located in Waiahole and Waikane Valleys, on Oahu's windward side approximately 10 miles northwest of Kaneohe Bay. The remaining acreage of the former Waikane Valley Training Area has been designated as a Formerly Used Defense Site (FUDS) under the Defense Environmental Restoration Program (DERP) by the U.S. Department of Defense (DoD), and is not addressed under this RI.

10.2 PRELIMINARY IDENTIFICATION OF ARARS AND TBC DOCUMENTS

The discussion of Federal Applicable or Relevant and Appropriate Standards, Limitations, Criteria, and Requirements (ARARs) and non-promulgated criteria, advisories, guidance or policies referred to as "to be considered" (TBC) materials is included in Appendix G Environmental Protection Plan of the work plan.

10.3 SITE HISTORY AND CURRENT CONDITIONS

The military use of WVIA dates from the early 1940's until 1976. Between 1943 and 1953, the Army leased this property for maneuvers, jungle training, small arms artillery, and mortar firing. The United States Marine Corps (USMC) leased the area in 1953. Training consisted of small arms fire, 3.5-inch rockets, and possibly artillery fire. Live fire stopped in the early 1960's due to fire hazards. The military lease of the property was terminated in 1976 and returned to the original owners who farmed and developed portions of the property.

In 1989, the government acquired title to the 187-acre WVIA, and completed construction of a perimeter fence in 1992. The property has since been under control and maintained by MCB Hawaii. The project site is currently managed as an "other than operational range", with access controlled by MCB Hawaii such that civilians may only enter the property when accompanied by Explosive Ordnance Disposal (EOD) personnel.

10.3.1 Previous Site Investigations

Previous site investigations include a 2004 Environmental Assessment, a 2006 Engineering Evaluation/Cost Analysis. For more details on these investigations please refer to Section 1.3 of the WVIA RI WP.

Naval Facilities Engineering Command, Pacific (NAFAC PAC) conducted site inspection activities at WVIA from 29 September to 30 October 2008. An instrument-aided field reconnaissance survey was conducted to evaluate and document the presence of MEC, MC, or other munitions-related finds. The field teams surveyed approximately 10 percent of the accessible areas of the site for a total of 14.75 surveyed acres. Transect surveys covered 9.55 acres and cell surveys covered 5.2 acres. Transects and cells were spread across the site as evenly as possible considering the rough terrain. Cells were located in open areas wherever possible to avoid disturbance of vegetation, and the ideal cell size of 50' by 50 ' was expanded or contracted to fit the available area. The soil sampling team collected 35 composite samples in the lower elevations of the site and 10 discrete samples at locations where MEC items had been found. Samples were analyzed for 9 metals and for nitroaromatics and nitroamines. The analytical results were compared against Project Action Limits (PALs) consisting of U.S. EPA Region IX Screening Levels (RSLs), State of Hawaii Department of Health (HDOH) Tier 1 Environmental Action Levels (EALs), and Soil Background Criteria.

Four target areas were identified as Areas of Concern (AOC). Many items of munitions debris (MD) were noted during the site inspection. Seventy MEC items were found, all fired and fuzed and therefore considered unexploded ordnance (UXO). The UXO items included sixty-six 3.5-inch shoulder fired High Explosive Anti-Tank (HEAT) Rockets, one 2.36 inch shoulder fired HEAT Rocket warhead, and three HEAT Rifle Grenades.

The analysis of four samples revealed a potential for copper and lead impacts above PALs. These localized concentrations of copper and lead are believed to be related to high concentrations of munitions debris at the four AOCs.

10.3.2 Physical Settings

WVIA is currently undeveloped with exception of a perimeter chain-linked fence. The property is bounded to the north, south, and west by undeveloped forested lands owned by Kualoa Ranch and SMF Enterprises, Inc. Non-contiguous coastal lands to the east of the project site include a mix of undeveloped, residential, beach park, and private property areas.

10.3.2.1 Climate

Due to the location of the Hawaiian Islands in the northern tropics and the presence of cooling trade winds, Oahu's climate is mild and pleasant. The prevailing winds throughout the year are the northeast trades. The trade winds are more persistent in the summer than in the winter. Trade winds in the winter are interrupted by winds from other directions, particularly the southerly Kona winds. Temperatures are coolest in January through March with mean daily temperatures of 69 degrees Fahrenheit (ºF) and warmest in August through September with mean daily temperatures of 75ºF. Relative humidity on Oahu ranges from 30 to 90 percent. The main mechanism for rainfall is warm, moist ocean air rising and cooling as it passes over the mountains causing precipitation. The average annual precipitation at WVIA is approximately 80 inches per year (Juvik and Juvik, 1998).

10.3.2.2 Physiography and Topography

Waikane Valley is one of several valleys with watersheds draining into the northern portion of Kaneohe Bay. The Waikane Stream borders the southern portion of WVIA and flows in an east to west orientation. Associated stream tributaries flow through the site into Waikane Stream in a north to south orientation. The project site is located on steeply sloped hilly and mountainous terrain with very dense vegetation both on the ground surface and as high as the tree top canopy. The project site extends along a gradient from 100-feet above mean sea level at the southern boundary, to approximately 1,400 feet along the northern ridge line. Much of the project area has slopes exceeding 45 percent, with some sections containing steep vertical cliffs.

10.3.2.3 GEOLOGY

The rocks of the Koolau mountain range are comprised chiefly of thin basalts with small amounts of ash. The Koolau volcanic series are comprised of lavas and dikes lying outside Koolau caldera and are altered only rarely by hydrothermal action. These lavas were erupted from two main rift zones in Pliocene time and a third southwest rift zone passing through Diamond Head (Stearns, 1985).

A detailed discussion on soil types within the project site can be found in Section 1.4 of the WVIA RI work plan.

10.3.2.4 HYDROGEOLOGY AND SURFACE WATER

The United States Geological Survey Groundwater Atlas of the United States HA 730-N indicates that WVIA site is located in the Koolau Rift Zone groundwater area of Oahu. This area consists mostly of dike-intruded Koolau Basalt, which is the principal aquifer. Regional groundwater movement is from the highlands to adjacent groundwater areas and directly to the ocean. Dike-impounded water is most important in this groundwater area, and some water levels are as much as 1,000 feet above sea level.

According to the HDOH map of Oahu's Underground Injection Control Areas, WVIA lies inland of the Underground Injection Control line, and therefore the underlying aquifer is considered a drinking water source.

The depth to groundwater has not yet been determined at this site. However, because of the steep terrain and underlying rock strata, it is assumed that infiltrated water along the slopes may accumulate in small pockets in the bedrock but generally flows towards Waikane Stream and is transported to the Pacific Ocean approximately one mile downstream from the site.

Waikane Stream traverses the project site along its southern border at approximately the 150-foot elevation. The U.S. Geological Survey has monitored stream flow at the 75-foot elevation approximately 1,150 feet downstream from the eastern border of the property since 1959. Its records indicate Waikane Stream to be perennial (Belt Collins & Associates 1990).

Since 1916, the Waiahole Ditch Tunnel System has intercepted water at the most productive portion of the Waikane catchment upstream from the site, thereby altering flow volume and other hydrological characteristics of Waikane Stream (Drigot et al 2001).

10.4 BIOLOGICAL RESOURCES

10.4.1 Vegetation

The project site has been highly disturbed in the past such that only remnants of native vegetation remain. Native plant communities occur on some of the ridges that extend to the northern ridge line. No distinct wetlands are found within the project site. Please refer to Section 1.4.4 of the WVIA RI work plan for more details on vegetation.

10.4.2 Fish and Wildlife

Non-native arthropod, mammalian, and avian species identified at the project site are consistent with the habitat found at the project site. Many common non-invasive species are present. The findings of the avian survey were consistent with the habitat and altitude of the study area. No native avian species were detected. A few native species of aquatic life were found in the middle and lower reaches of Waikane Stream. Please refer to Section 1.4.4 of the WVIA RI WP for more details on fish and wildlife.

10.4.3 Listed Endangered Species

Previous surveys of the project site in 1989 and 2003 found no federally listed threatened or endangered plan species and no plans proposed for such status. Please refer to Section 1.4.4 of the WVIA RI WP for more details on listed endangered species.

10.5 Conceptual Site Model

10.5.1 Source Area and Source Media

During the 2008 SI, the entire suspect area was investigated and sampled for the continued presence of source media (e.g., impacted soils and munitions) and sampled for the continued presence of MC.

The SI confirmed presence of small arms, rifle grenades, and 2.36-inch and 3.5-inch rockets as source media at WVIA. The maximum penetration depth of these identified munitions is 2-feet below ground surface (bgs). In addition, evidence gathered during the reconnaissance survey indicates that 4 distinct target areas were used within the MRS. These target areas are identified as AOCs 1 through 4 and are shown on Figure A-4 of the RI work plan. Mortars and projectiles were not fired at these targets, although a 75 mm base plate and a mortar fuze were found. These two items were apparently kick-outs from detonations at other targets on the adjacent FUDS property.

The preliminary CSM considered aluminum, antimony, barium, chromium, copper, iron, lead, nickel, and zinc as potential MC because of their use in production of the above source media. Nitroamines and nitroaromatics were potential MC because of their use as propellants and explosives. Based on the results of the 2008 SI sampling analysis, only copper and lead exceeded PALs in four localized soil samples. The four samples exceeded the 230 mg/kg PAL for copper (maximum concentration 1,300 mg/kg) and two of those four samples exceeded the 200 mg/kg PAL for lead (maximum concentration 960 mg/kg). The 4 samples were taken from points shown on Figure A-4 of the RI work plan, and are located within the AOCs identified.

Copper and lead were identified as COPCs for all AOCs during the scoping meeting session by the project team and the regulatory oversight HDOH. The project team proposed the subsampling soil approach, analyte list and that groundwater exposure is not of concern which HDOH agreed on. Other decisions made during the scoping meeting can be found in Worksheet #9. The additional COPCs cobalt, mercury, and RDX were identified in the review process of the draft MC SAP when a SI report of the Pali, Heeia, and Waikane areas by the Army Corps of Engineers became available that identified these COPCs as analytes that were above HDOH EALs in surface water samples of Waikane Stream.

10.5.2 Release Profile, Exposure Media, and Exposure Routes

The *release profile* for the potential MC contamination is identified as MC transported with soil erosion and surface water runoff. The potential *exposure media* would include surface soils, subsurface soil, and inland surface water/sediments.

Transport pathways leading to potential exposure to on-site receptors also tend to result in reduced MC concentrations at receptor points distant from the MRS. Although chemicals from MEC items may have leached into the soil, conditions at the site are not conducive to migration of heavy metals contaminants through subsurface soil to the groundwater. Hawaiian rains are essentially free of industrial acids associated with dissolving metals in soils, and therefore metals do not migrate easily through subsurface soil to groundwater. Because the maximum penetration depth of munitions used at WVIA is 2 feet bgs, it is unlikely for MC to have migrated to depths larger than 3 feet bgs. In addition, groundwater at the site quickly empties into Waikane Stream because of the steep terrain and underlying rock strata, and is transported to the Pacific Ocean approximately one mile downstream. This significantly reduces the potential for human exposure to MC in groundwater. Therefore groundwater is not considered as a exposure media in accordance with the decisions made during the scoping meeting with HDOH.

Dermal contact, incidental ingestion, and inhalation of resuspended solids are *potential exposure routes* and are explained further in 10.5.4.

Chemical transport within surface water runoff may result in MC entering the Waikane Stream, which is down-gradient from the four sampling locations which exceeded PALs. Attenuation processes are likely to reduce chemical concentrations to the point that exposure at the Stream is insignificant, and therefore this pathway is considered incomplete for all on-site receptors.

10.5.3 Receptors

10.5.3.1 HUMAN

The CSM evaluates three potential human receptor groups: (1) current and future offsite residents, (2) future onsite residents and construction workers, and (3) current and future onsite recreational users. There are currently no onsite residents.

10.5.3.2 ECOLOGICAL

The ecological receptor CSM evaluates two potential receptor groups: (1) terrestrial wildlife, and (2) aquatic wildlife. To further evaluate the potential for ecological risk from the COPCs, an assessment consistent with the objectives and requirements of Step 3a of Tier 2 (Baseline Ecological Risk Assessment, or BERA) of the Navy's overall tiered process was conducted, and is provided as Appendix F of the work plan. The Hawaiian short-eared owl, or pueo, was selected as the assessment endpoint because it is a species of concern in the State of Hawaii, may at times forage on small animals at WVIA, and is therefore a potential receptor of contaminants occurring there. The pueo would be expected to experience a high-end exposure to any potential MC due to its position in the food web, and therefore is considered a conservative representation of other birds using the site.

10.5.4 Pathway Analysis

Figure A-4 of the RI work plan illustrates both MEC and MC source-receptor interactions at WVIA.

10.5.4.1 HUMAN

Analysis of the profile information allowed USAE to identify source-receptor interactions (exposure pathways) for the MRS. For MC, exposure pathways include source and exposure media, exposure routes, and receptors.

For the MC source area (targets), the chemicals of potential concern are heavy metals and nitroaromatics/nitroamines, depending on the exposure medium as detailed below. The MC exposure media for this MRS have been identified as surface soil, subsurface soil, and surface water/sediments and exposure routes are dermal contact, incidental ingestion and inhalation of resuspended solids.

Dermal, inhalation, and ingestion exposure pathways are potentially complete to future onsite residents and construction workers, and current and future onsite recreational users through erosion and runoff to contaminated surface soil and surface water and sediments of Waikane Stream.

Extensive erosion of the target areas has occurred in the past, and further erosion is anticipated in the future. It should be noted however that erosion would not be sufficient to transport MEC off site. This is evident in that erosion has not visibly transported MEC to Waikane Stream, which is the only mode of transport off site. The exposure pathway to offsite receptors is incomplete for all exposure media and routes because of the attenuating effect of distance from the site.

Inhalation of windblown (resuspended) particulates is not considered a potentially complete exposure route for surface water and sediment because of the wet climate, heavy vegetation, and high canopy which provides protection from the wind. DOH agreed during the scoping meeting that surface water would not need to be sampled and sediment samples will be representative of what might be deposited into the stream along the potentially complete pathway to the stream surface water and sediments via surface water runoff.

Human activity such as excavation conducted by future onsite residents and construction workers, and future and current onsite recreational users (or trespassers) may result in exposure to MC contaminated subsurface soil.

Hawaiian rains are essentially free of the industrial acids and other chemicals typically associated with dissolving metals in soils, and therefore metals do not migrate easily through subsurface soil to the groundwater. Although a drinking water aquifer is located below this site, groundwater at the site passes quickly into Waikane Stream because of the steep terrain, and empties into the Pacific Ocean approximately a mile downstream. Since metals in soil have a low affinity for dissolving in the local waters, and since the groundwater passes quickly through the site and to the ocean, this pathway is considered incomplete.

10.5.4.2 ECOLOGICAL

Analysis of the profile information allowed USAE to identify source-receptor interactions (exposure pathways) for the MRS.

Foraging activities of onsite terrestrial ecological receptors (such as the short-eared owl) may result in direct contact exposure to and incidental ingestion of contaminated surface soil, and burrowing activities may result in direct contact exposure to contaminated subsurface soil. The pathway is incomplete for terrestrial animals to contact MC in onsite groundwater, since metals have a low affinity for dissolving in the local waters, and since the groundwater passes quickly through the site and to the ocean (see also 10.5.2). Potentially complete exposure pathways have been identified for aquatic ecological receptors to surface water and stream sediments and will be further evaluated during this RI. Inhalation of windblown (resuspended) particulates is not considered a potentially complete exposure route for surface water and sediment because of the wet climate, heavy vegetation, and high canopy which provides protection from the wind.

Even though pathways may be potentially complete for ecological and human receptors, the BERA results indicate that **risk** to ecological receptors is *de minimis* and meets the HDOH regulatory limits. +The potential risks to ecological receptors associated with surface water and sediment will be further evaluated during this RI.

Worksheet #11: Project Quality Objectives / Systematic Planning Process Statements

11.1 PROJECT QUALITY OBJECTIVES

The project quality objectives (PQOs) for this RI were developed in accordance with the EPA *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA QA/G-4, 2006b). It should be noted that the PQOs were developed under the assumption that the activities performed during the MEC RI effort will not affect the MC CSM. This document addresses the hazards/threat associated with MC, whereas all MEC related issues are discussed in a separate document (MEC SAP). Based on the information presented in Worksheet #10, the PQOs for this project are summarized below.

11.1.1 Problem Statement

The primary objective of this RI is to evaluate the nature and extent of the hazards/threat to human health and/or the environment associated with the presence of MC in surface soils, subsurface soils, and Waikane Stream sediments resulting from past military practices at 5 defined AOCs.

11.1.2 Identify Decisions

The principal questions for WVIA are as follows:

- What is the nature and extent of the hazards/threats to human health associated with the exposure to MC (copper and lead) in surface soils within AOCs 1 through 4 at depth of 0-6 inches below ground surface (bgs)?
- What is the nature and extent of the hazards/threats to human health associated with the exposure to MC (copper and lead) in subsurface soils within AOCs 1 through 4 at depths of 2 and 3 feet bgs?
- What is the nature and extent of the hazards/threats to human health and the environment associated with the exposure to MC (cobalt, copper, lead, mercury, and RDX) in Waikane Stream sediments within AOC 5?
- Based on the results of the sediment samples, what is the nature and extent of the hazards/threats to human health and the environment associated with the exposure to MC (cobalt, copper, lead, mercury, and RDX) in Waikane Stream?
- What is the nature and extent of the hazards/threats to human health associated with the exposure to MC (heavy metals and explosive compounds) in surface soils at locations where MEC is blown-in-place (BIP) during MEC clearance activities?

The study questions have been used to develop the following decision statements that link the question with a recommended action. The decision statements are as follows:

- If concentrations of copper and lead in the surface soils (0-6 inches bgs) within AOCs 1 through 4 do not exceed the PALs, then no further action (NFA) will be recommended. If concentrations of copper and lead in surface soils within AOCs 1 through 4 do exceed the PALs, then appropriate further evaluation shall be conducted (e.g., human health risk assessment, evaluation of remedial alternatives, etc.).
- If concentrations of copper and lead in subsurface soils (2 and 3 feet bgs) within AOCs 1 through 4 do not exceed the PALs, then NFA will be recommended. If concentrations of

copper and lead in subsurface soils within AOCs 1 through 4 do exceed the PALs, then appropriate further evaluation shall be conducted (e.g., human health risk assessment, evaluation of remedial alternatives, etc.).

- If concentrations of cobalt, copper, lead, mercury, and RDX in sediments within Waikane Stream (AOC 5) do not exceed the PALs, then NFA will be recommended. If concentrations of these COPCs in sediments within Waikane Stream (AOC 5) do exceed the PALs, then appropriate further evaluation shall be conducted (e.g., human health and ecological risk assessment, evaluation of remedial alternatives, etc.).
- If concentrations of heavy metals and explosive compounds in surface soil at BIP locations do not exceed the PALs, then NFA will be recommended. If concentrations of these COPCs in surface soils at BIP locations do exceed the PALs, then appropriate further evaluation shall be conducted (e.g., human health and ecological risk assessment, evaluation of remedial alternatives, etc.).

11.1.3 Inputs to the Decisions

Based on the results of 2008 SI, current site use, and regulatory requirements, the inputs to the decisions will include the following:

- WVIA historical data.
- Analytical results from previous investigations.
- Findings of the September 2009 *Site Investigation Report Pali Training Camp, Heeia Combat Training Area, and Waikane Training Area, Oahu, Hawaii,* prepared by Wil Chee - Planning, Inc. for U.S. Army Corps of Engineers (this report became available during the review process of the draft MC SAP and let to the decision of analyzing sediment samples also for cobalt, mercury, and RDX in addition to copper and lead).
- Findings of the June 2009 *Ecological Risk Evaluation for Waikane Valley Training Area, Kaneohe, Oahu, Hawaii*, prepared by CH2M Hill for NAVFAC Pacific.
- Additional analytical data to be collected from surface soils, subsurface soils and Waikane Stream sediments at WVIA.
- Surface soils are to be analyzed for the copper and lead using EPA SW-846 method 6010B.
- Surface Soil at BIP locations are to be analyzed for aluminum, antimony, barium, chromium, copper, iron, lead, nickel, and zinc using EPA SW-846 method 6010B and nitroaromatics and nitroamines using EPA SW-846 method 8330.
- Subsurface soils are to be analyzed for copper and lead using EPA SW-846 method 6010B.
- Waikane Stream sediment samples are to be analyzed for cobalt, copper, and lead using EPA SW-846 method 6010B, mercury using EPA SW-846 method 7471, and RDX by EPA SW-846 method 8330.
- Surface and subsurface soil screening criteria for protection of human health (direct exposure) using Summer 2008 (updated March 2009) HDOH Environmental Action Levels

(EALs) for unrestricted sites where drinking water is threatened and the nearest surface water body is within less than 150 meters. In case an EAL for a specific analyte does not exist December 2009 EPA residential Regional Screening Levels (RSLs) will be utilized.

- Waikane Stream sediment screening criteria for protection of human health and the environment using the more conservative value of either National Oceanographic and Atmospheric Association (NOAA) Sediment Quality Guidelines (Buchman 2008) or 2004 EPA Region III Biological Technical Assistance Group (BTAG) freshwater sediment screening benchmarks. The NOAA sediment benchmarks chosen for this project are based on the lowest effect level (LEL) for inorganics in freshwater sediment. This LEL of sediment contamination can be tolerated by the majority of benthic organisms.

- Background heavy metal concentrations in Koolau Volcanic Caprock Soil in accordance with Navy Policy on the Use of Background Chemical Levels. The estimated background concentration ranges are contained in the *Environmental Background Analysis of Metals in Soil at Navy Oahu Facilities, Oahu, Hawaii* (DON 2004).

- Assumption that MEC SAP activities will not change the MC CSM.

- Maximum penetration depth of munitions used at WVIA is 2-feet bgs.

- Practical restraints (i.e., dense vegetation and steep terrain).

11.1.4 Boundaries of the Study

The temporal boundaries for this RI will be the period of the actual MC field investigation, anticipated to occur in March and April 2010. Physical boundaries are as follows:

Surface Soil Samples

- Surface soil sampling will be limited to 10 Decision Unit areas which encompass the entirety of AOCs 1 through 4. In addition, up to 10 BIP locations will be sampled following MEC clearance activities. BIP sample locations will be determined based on MEC clearance efforts. All surface soil samples will be collected at depth of 0-6 inches bgs.

Subsurface Soil Samples

- Subsurface soil samples will be limited to 10 discrete locations within AOCs 1 through 4 and will be collected at depths of 2 and 3 feet bgs.

Note: A maximum sampling depth of 3 feet was selected by the project team based on the following factors: The penetration depth of the munitions previously identified at WVIA is 2 feet bgs; Hawaiian rains are essentially free of industrial acids and other chemicals typically associated with dissolving metals in soils, and therefore metals do not migrate easily through subsurface soil; and erosional processes exposing MEC at shallower depths over time.

Sediment Samples

- Sediment samples will be limited to 3 composite sampling areas (upstream, midstream, and downstream) encompassing the entire portion of Waikane Stream which flows through the WVIA. Sediment samples will be collected at depth of between 0 and 6 inches bgs.

11.1.5 Developing Decision Rule

The nature and extent of the COPCs will be evaluated and compared to the PALs. Decision rules were developed to specify the statistical parameter of interest characterizing the population of interest. The decision rules are:

Surface Soil Samples

- The maximum measured concentration was chosen as the most appropriate parameter for evaluating copper and lead within AOCs 1 through 4 against the PALs.

- The maximum measured concentration was chosen as the most appropriate parameter for evaluating concentrations of total metals and explosive compounds from each discrete BIP sampling location.

Subsurface Soil Samples

- The maximum measured concentration was chosen as the most appropriate parameter for evaluating concentrations of copper and lead from each discrete sampling location within AOCs 1 through 4 against the PALs.

Sediment Samples

- The maximum measured concentration was chosen as the most appropriate parameter for evaluating concentrations of copper and lead from each composite sampling area within AOC 5 against the PALs.

11.1.6 Specify Tolerable Limits on Decision Errors

Two potential decision errors could be made based on interpreting sampling and analytical data:

Decision Error A: Concluding that the concentration of a COPC is not statistically higher than the PALs, when it actually is.

Decision Error B: Concluding that the concentration of a COPC is statistically higher than the PALs, when it actually is not.

For this project, Decision Error A would pose more severe consequences, because the true state of contamination could go undetected and may cause a greater risk to human health and/or the environment. Consequently, the baseline condition chosen for this site was that the concentration of a COPC within surface soil, subsurface soil, and Waikane Stream sediments was truly (significantly) greater than the PALs. In statistical language, the baseline condition becomes the null hypothesis (H_o), which can be written as:

> H_o: Concentration of COPCs > PALs (assume surface soil, subsurface soil, and sediment are contaminated)

A false rejection (Type 1 Error Rate or alpha) decision error occurs when the null hypothesis is falsely rejected. In this case, such an error would have occurred if a determination was made that COPCs concentrations are less than or equal to the PALs, when in fact, the true concentration is greater than the PALs.

A false acceptance (Type II Error Rate or beta) decision error occurs when the null hypothesis is falsely accepted. In this case, such an error would have occurred if the data indicated that concentrations of COPCs were significantly greater than the PALs, when in fact, the true concentration is less than the PALs.

The grey region (delta) defines a range that shows that COPC concentrations are higher than the PALs, but not significantly different, given the uncertainty in the data. When the null hypothesis assumes that the site is contaminated, the upper limit of the gray region is bounded by the PALs.

Probability values to decision errors were calculated using Visual Sampling Plan (VSP) Version 5.4.2. Based on the planned number of surface soil, subsurface soil, and sediment samples, the acceptable rate of false rejection (alpha) will be 5%, and the acceptable rate of false acceptance (beta) will be 10%.

11.1.6.1 MINIMIZATION OF DECISION ERROR DUE TO SAMPLING

Potential errors associated with the sampling design used to generate the sampling locations at WVIA are discussed below.

Sampling locations were selected based on the results of the 2008 SI. The 2008 SI results were carefully reviewed to minimize the probability of overlooking a potential area of concern. However, it is possible that a sample may not represent an entire area. Mitigating this possibility is the common-sense approach to locating samples downgradient of possible target locations. The sampling design and rationale are presented in Worksheet #17.

Sampling error due to incomplete equipment decontamination, inappropriate sampling techniques, and/or improper preservation may occur during field sampling efforts. To minimize sampling error, the NAVFAC Pacific Environmental Restoration (ER) Program Procedures (DON 2007) for soil sample collection and equipment decontamination will be followed.

Worksheet #12: Measurement Performance Criteria Table

Measurement Performance Criteria Table – Field QC Samples

QC Sample	Analytical Group	Frequency	Data Quality Indicators (DQIs)	Measurement Performance Criteria (MPC) [a]	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
Subsurface Soil (Discrete Sampling)					
Field Duplicate (co-located)	Copper and lead	10% of primary samples collected per matrix per analytical method	Precision	RPD $\leq$ 30%	S & A
Matrix Spike / Matrix Spike Duplicate	Copper and lead	5% of primary samples collected per matrix per analytical method	Precision	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS (QSM 4.1)	A
Equipment Blank	Copper and lead	One per sampling technique using non-disposable equipment per location	Representativeness	No detectable target analytes < 1/2 RL	S & A
Surface Soil (MI Sampling)					
Replicate Samples	Copper and lead	Three per decision unit	Precision	RPD $\leq$ 50%	S & A
Sediment (Composite Sampling)					
Field Duplicate (co-located)	Copper, cobalt, lead, mercury, and RDX	10% of primary samples collected per matrix per analytical method	Precision	RPD $\leq$ 30%	S & A
Matrix Spike / Matrix Spike Duplicate	Copper, cobalt, lead, mercury, and RDX	5% of primary samples collected per matrix per analytical method	Precision	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS (QSM 4.1)	A
BIP Surface Soil (Discrete Sampling)					
Field Duplicate (co-located)	Nitroaromatics / nitroamines and heavy metals	10% of primary samples collected per matrix per analytical method	Precision	RPD $\leq$ 30%	S & A
Matrix Spike / Matrix Spike Duplicate	Nitroaromatics / nitroamines and heavy metals	5% of primary samples collected per matrix per analytical method	Precision	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS (QSM 4.1)	A
Equipment Blank	Nitroaromatics / nitroamines and heavy metals	One per sampling technique using non-disposable equipment per location	Representativeness	No detectable target analytes < 1/2 RL	S & A

%	percent	MI	multi-incremental	RPD	relative percent difference
A	analytical	MPC	measurement performance criteria	RSD	relative standard deviation
DoD	Department of Defense, United States	QC	quality control	S	sampling
DQI	data quality indicators	RDX	cyclo-1,3,5-trimethylene-2,4,6-trinitramine		
LCS	laboratory control sample	RL	reporting limit		

Worksheet #13: Secondary Data Criteria and Limitations Table

Secondary Data Criteria and Limitations Table

Secondary Data	Data Source	Data Generator(s)	How Data Will Be Used	Limitations on Data Use
Previous sampling data for the WVIA	*Site Inspection Waikane Valley Impact Area, Kaneohe, Oahu, Hawaii* (USACE 2008)	Army Corps of Engineers, 2008	Background documentation and rationale for sampling design and for sample locations. Identify AOCs based on sample locations that exceeded project action levels.	No subsurface or sediment samples taken to delineate vertical extent.
Preliminary Assessment (PA) Report	*Preliminary Range Assessment and Archive Search Report for the Waikane Valley Training Area*	Army Corps of Engineers, 1998	To provide historical information about the site.	Archives data search was extensive, but site survey was limited to cursory walk-over.
Site Survey and Initial OEW Risk Assessment	*DERP-FUDS Inventory Project Report, Waikane Training Area, Island of Oahu, Hawaii, Site No. H09H1035400*	Army Corps of Engineers, 1996	To provide historical information about the site.	Data is from a limited site survey conducted over ten years ago.
Geology and groundwater data	*Geology and Groundwater Resources of the Honolulu-Pearl Harbor Area*	City and County of Honolulu, Board of Water Supply, 1951	Creation of CSM	Data to be used as a reference only
Oahu climate data	*Atlas of Hawaii, Third Edition*	Department of Geography, University of Hawaii at Hilo, 1998	Creation of CSM	Data to be used as a reference only
Oahu geological data	*Geological Map and Guide of the Island of Oahu, Hawaii*	Department of the Interior, 1985	Creation of CSM	Data to be used as a reference only
Ecological Risk Assessment	*Ecological Risk Evaluation for Waikane Valley Training Area*	Department of the Navy, NAVFAC Pacific, 2009	To provide ecological risk analysis for WVIA copper and lead contaminated soils	Risk analysis is based only on surface soil data. No subsurface, sediment, or groundwater data was considered.
Background levels of metals in soil	*Environmental Background Analysis of Metals in Soil at Navy Oahu Facilities, June 2006*	Department of the Navy, NAVFAC Pacific, 2006	Creation of CSM	Data to be used as a reference only
Oahu climate data	*Rainfall Atlas of Hawaii*	State of Hawaii, Department of Land and Natural Resources, 1986	Creation of CSM	Data to be used as a reference only
Hydrologic data	*Geohydrology of the Island of Oahu, Hawaii*	U.S. Geological Survey, 1996	Creation of CSM	Data to be used as a reference only
Waikane Valley soil data	*Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai*	United States Department of Agriculture, Soil Conservation Services, 1972	Creation of CSM	Data to be used as a reference only

AOC area of concern
COPC chemical of potential concern
CSM Conceptual Site Model
DERP Defense Environmental Restoration Program
FUDS Formerly Used Defense Sites
HDOH Department of Health, State of Hawaii
OEW ordnance and explosive waste
USACE United States Army Corps of Engineers
WVIA Waikane Valley Impact Area

Worksheet #14: Summary of Project Tasks

14.1 FIELD SAMPLING TASKS

Establish and mark the locations. Conduct soil sampling with the oversight of a UXO Technician II / I. Ship the soil samples to the analytical DoD ELAP accredited laboratory.

- Site Preparation
- Geophysical and Utility Clearance Survey – NAVFAC Pacific ER Program Procedure I-A-5, Utility Clearance and NAVFAC Pacific ER Program Procedure I-B-2, *Geophysical Testing Procedures* (DON 2007)
- Soil Sampling - NAVFAC Pacific ER Program Procedure I-B-1, *Soil Sampling* (DON 2007)
- Subaqueous Sediment Sampling - NAVFAC pacific ER Program Procedure I-B-6, *Subaqueous Sediment Sampling* (DON 2007)
- Equipment Decontamination – NAVFAC Pacific ER Program Procedure I-F, *Equipment Decontamination* (DON 2007)
- IDW Management – NAVFAC Pacific ER Program Procedure I-A-6, *IDW Management* (DON 2007)
- Sample Location Survey – NAVFAC Pacific ER Program Procedure I-I, *Land Surveying* (DON 2007)

14.1.1 Site Preparation

The contractor shall conduct surficial MEC removal and clearance as a Level 2 Imminent and Substantial Endangerment Response. The contractor shall make the necessary notifications and obtain the necessary permits. Surficial removal and clearance is expected to be within approximately the upper one foot of the ground surface. The surficial MEC removal will also assist in the evaluation of the subsurface extent of the MEC. Additionally, site preparation will involve clearing of vegetation to assist in the multi-incremental soil sampling process.

14.1.2 Geophysical and Utility Clearance Survey

Prior to the commencement of intrusive subsurface work, available utility maps will be reviewed. In addition, a magnetic anomaly survey will be conducted at each proposed multi-incremental sampling and subsurface sampling location. It is anticipated that instrumentation consisting of an electromagnetic pipe and cable locator, an electromagnetic induction detector, and a magnetometer will be employed. The location of all suspected subsurface anomalies will be marked on the ground surface using stakes or flagging and will be identified on the WVIA layout map. Due to the past use of the site as a munitions impact area, magnetic anomaly searches may have only limited utility. All intrusive work shall be conducted with extreme caution due to these limitations.

If proposed sampling locations are determined to be unacceptably close to other geophysical anomalies, the sampling locations will be moved to a new, cleared location. Locations of samples and underground anomalies will be recorded and located on a map.

14.1.3 Soil Sampling

14.1.3.1 MULTI INCREMENTAL SURFACE SOIL SAMPLING

The four target location AOCs will be investigated by collecting MI samples within a total of 10 decision units (DUs) at the WVIA. The rationale for selecting these decision units was based on existing knowledge of known or suspected MEC and MC contamination, as well as areas downgradient where MC may have migrated. These decision units adequately cover the 4 suspected target locations identified during the 2008 SI. Rationale for selecting the 10 DUs is discussed in Worksheet #17.

Each DU will be investigated by collecting 3 replicate MI samples, for a total of 30 samples from the four target location AOCs. Each MI sample will be comprised of 30 individual soil increments, consisting of a maximum of 34 grams per increment (total of 1,000 grams per sample). MI samples will be analyzed for copper and lead by EPA SW-846 method 6010B.

14.1.3.2 SUBSURFACE SOIL SAMPLING

A total of 10 subsurface sample locations (1 from each DU) will be investigated by collecting two samples from 2 and 3 feet bgs at each location in order to characterize the vertical extent of copper and lead contamination within each of the target area AOCs. Proposed subsurface soil sample locations are depicted in Figures 2 and 3. Sample locations may be subject to change based on the results of the geophysical survey discussed in Section 10.5.2. Discrete subsurface soil samples will be analyzed for copper and lead by EPA SW-846 method 6010B.

The number of subsurface soil sample locations was limited to 10, as it is presumed that the soil conditions at the surface are representative of subsurface conditions. This presumption has been made based on the steep gradients at the site, causing surface soils to erode to lower elevations over time. Additionally, Hawaiian rains are essentially free of the industrial acids and other chemicals typically associated with dissolving metals in soils, and therefore metals do not migrate easily through subsurface soil. The 10 subsurface soil sample locations will be investigated to confirm this presumption. This level of uncertainty will be made up for by the MI surface soil results.

14.1.3.3 BIP SURFACE SOIL SAMPLING

A total of 10 BIP locations will be investigated prior to and following MEC clearance activities to determine the nature and extent of the effects caused by BIP efforts. This will be done by collecting one discrete surface soil sample from 0-6 inches bgs at each location prior to, and following BIP activities. BIP samples will be analyzed for heavy metals by EPA SW-846 method 6010B and explosive compounds by EPA SW-846 method 8330.

14.1.4 Subaqueous Sediment Sampling

Waikane Stream has been identified as AOC-5 for this RI. The portion of Waikane Stream that flows through WVIA will be divided into three equally sized sampling areas (i.e., upstream, midstream, and downstream), as depicted in Figures 2 and 3. From each of these three areas, one composite sediment sample consisting of 30 increments will be collected for the COPCs from the stream bed at depths between 0-6 inches bgs. Rationale for selecting composite sampling methods over MI sampling methods is discussed in Worksheet #17. Sediment samples will be analyzed for cobalt, copper, and lead by EPA SW-846 metod 6010B, mercury by EPA SW-846 method 7471, and RDX by EPA SW-846 method 8330.

14.1.5 Equipment Decontamination

Decontamination of hand augers used in subsurface soil sampling and sediment sampling is necessary to prevent cross-contamination and to maintain the highest integrity possible in collected samples. Decontamination of such equipment shall be conducted between each sampling location. The decontamination procedure shall consist of the following: (1) wash with a non-phosphate detergent (alconox, liquinox, or other suitable detergent) and potable water solution; (2) rinse in a bath with potable water; (3) spray with laboratory-grade isopropyl alcohol; (4) rinse in a bath with deionized or distilled water; and (5) spray with deionized or distilled water. If possible, hand augers will be disassembled prior to cleaning.

14.1.6 Investigation Derived Waste (IDW) Management

It is anticipated that IDW will be limited to decontamination rinsate generated from decontaminating the stainless steel hand augurs needed to collect subsurface soil samples, and personal protective equipment such as coveralls and nitrile gloves. It is anticipated that personal protective equipment will be non-hazardous and suitable for disposal at a municipal landfill. Because it is anticipated that only a small quantity of decontamination rinsate will be generated during the project, all IDW decontamination water will be re-infiltrated at each subsurface soil sample location

14.1.7 Sample Location Survey

Experienced field personnel will use a Global Positioning System (GPS) to position sample locations at the site. The boundaries of each AOC, as well as all discrete, composite, and multi-incremental sampling locations will be included in the site survey.

14.2 SAMPLE MANAGEMENT

A sample label with adhesive backing shall be affixed to each individual sample container. Clear tape shall be placed over each label to prevent the labels from tearing off, falling off, being smeared, and to prevent loss of information on the label. These labels will be printed from a computer file on adhesive labels, or alternatively obtained from the analytical laboratory.

Standard sample custody procedures will be used to maintain the quality of the samples during collection, transport, and storage prior to the analysis. The following documents will be prepared to ensure proper sample identification:

- Sample identification label
- Custody seals
- Chain of custody records
- Field notebooks

The chain of custody form also serves as an analytical request form and as a place to record sample condition upon receipt. Custody seals will be signed and then placed over each cooler to detect potential tampering. The Chain of Custody (COC) form will reflect the time zone for accurate tracking of holding times.

14.3 ANALYSIS TASKS

The analytical laboratory will prepare, process, and analyze the soil samples for each analytical group, as noted in Worksheet #12 and 15. The results of the analytical data will be sent to the data validators.

14.4 QUALITY CONTROL TASKS

SOPs will be strictly adhered to during sample collection, packaging, and shipping tasks. The QC samples noted in Worksheet #12 and #26 will be analyzed for each analytical group.

14.5 SECONDARY DATA

Data from previous surveys and inspections (e.g., the PA noted in Worksheet #13) will be reviewed and evaluated for use in this project. Limitations in the use of the data will be noted.

14.6 DATA MANAGEMENT

Soil sampling and sediment data will be provided by the analytical laboratory and data validating firm in hard copy and electronic format. Electronic data will be downloaded into the Navy NIRIS database. The analytical data will be summarized and included in the RI/FS report.

14.7 DOCUMENTATION AND RECORDS

Worksheet #29 contains a list of the project documents and records that will be generated.

14.7.1.1 PROJECT DOCUMENT AND RECORDS GENERATION

Sample collection documents and records will be produced by the project sampling team during field activities. Offsite analysis documents and records will be produced by the analytical laboratory as noted in Worksheet 11. Hard copy, printed analytical data report will be delivered on Contract Laboratory Program (CLP)-like forms, along with case narrative, table of contents and raw data. Data assessment documents and records will be produced by the data validators and will be include validated data, validation reports, and a data quality analysis report. Validated data will consist of CLP-like forms with associated qualifiers and qualification codes. Hard copy validation reports will include a case narrative describing discrepancies or anomalies in the data and the validated data themselves. Other project assessment documents consisting of any field audit reports and/or corrective action forms will be generated as noted in Worksheets 31 through 33.

14.7.1.2 DATA DOCUMENT AND RECORDS MANAGEMENT

Electronic Data Deliverables (EDDs) will be loaded into a Microsoft Access 2000 (or higher) relational database directly from electronic versions of the data obtained from the analytical laboratory. Computer files will be backed up daily to avoid losing information. Hard-copy documents will be stored in secure areas in the WCP Honolulu office. Electronic data will be stored in password protected files, with read-only access to users not authorized to edit the data.

14.7.1.3 DATA DOCUMENT AND RECORDS STORAGE

Copies of all analytical data packages will be stored on CD-ROM diskettes and archived in the administrative record at NAVFAC Pacific at the close of the project. Laboratory data record retention will be 5 years and consistent with the DoD QSM. All other data documents and records generated for the project will be stored as both hard copies and computer readable data files by the WCP Honolulu office.

14.8 ASSESSMENT / AUDIT TASKS

Effective October 1, 2009, laboratories performing work in support of the Navy Environmental Restoration Program must be accredited through the DoD ELAP. The primary laboratory Curtis and Tompkins, Ltd. was accredited by The American Association for Laboratory Accreditation (A2LA) on 8 December 2009. A field audit and field logbook assessment will be conducted during field sampling activities. Refer to Worksheet 31 for more information on the planned project assessment and audits. Worksheet 37 contains information on the data usability assessment. Results of any field sampling audits will be maintained with project files.

14.9 DATA REVIEW TASKS

Analytical data will be validated in accordance with Procedure II-A, *Data Validation Presentation,* of the *Project Procedures Manual, US Navy Environmental Restoration Program, NAVFAC Pacific,* February 2007. Validated analytical data will be reviewed by the Project Geologist, Field Manager and the QA Chemist. The results of soil and sediment sampling will be compared to the PALs. Data usability will be assessed by the project team. A peer review of the draft and final RI/FS Report will be conducted by the project team prior to submittal.

Worksheet #15: Reference Limits and Evaluation Tables

The tables below list the laboratory practical quantitation limit (PQL) and the method detection limit (MDL) for each analyte in each matrix and analytical group to be analyzed on this project, along with the lowest applicable project AL and the project quantitation limit (QL) goal. The project QL goal is the lowest concentration or amount of the target analyte required to be reported from a data collection project (DoD 2009). Project QL goals have been set at the laboratory PQL. The units of measure for soil and sediment are presented in milligram per kilogram (mg/kg).

15.1 SOIL REFERENCE LIMITS AND EVALUATION TABLES

Matrix: **Soil**

Analytical Group: **Heavy Metals** – EPA SW-846 Method 6010B

Analyte	CAS No.	Project AL [a] (mg/kg)	Project AL Reference [a]	HDOH EALs (mg/kg)	EPA RIX RSLs (mg/kg)	Project QL Goal (mg/kg)	Laboratory-Specific Limits (mg/kg)	
							PQLs	MDLs
Aluminum [b]	7429-90-5	77,000	RSL-NC	NA	77,000 [nc]	5	5	1.3
Antimony [b] (metallic)	7440-36-0	6.3	EAL-DE	6.3	31 [nc]	0.5	0.5	0.16
Barium [b]	7440-39-3	3,100	EAL-DE	3,100	15,000 [nc]	0.25	0.25	0.10
Chromium (total) [b,d]	7440-47-3	500	EAL-Background	500	NA	0.25	0.25	0.10
Copper	7440-50-8	630	EAL-DE	630	3,100 [nc]	0.25	0.25	0.10
Iron [b]	7439-89-6	55,000	RSL-NC	NA	55,000 [nc]	5	5	1.6
Lead	7439-92-1	400	EAL-DE	400	400 [nc]	0.25	0.25	0.073
Nickel [b] (soluble salts)	7440-02-0	310	EAL-DE	310	1,600 [nc]	0.25	0.25	0.20
Zinc [b] (metallic)	7440-66-6	4,700	EAL-DE	4,700	24,000 [nc]	1	1	0.20

[a] The project action level is derived from the 2009 HDOH EALs for unrestricted land use, threat to drinking water resource, and <150 m from nearest surface water body. In cases where no EAL exists the 2009 EPA Region IX residential RSL is used in place of the EAL. Direct exposure/human health EALs were chosen over terrestrial ecotoxicity based on the result of the BERA (CH2M HILL 2009) indicating that no risk to ecological receptors exists with respect to soil at WVIA.
[b] Analyte applies only to BIP samples.
[c/nc] RSL based on carcinogenic/non-carcinogenic endpoint
[d] Naturally background in Hawaii can exceed 500 mg/kg (default assumed background). Natural background may be lower in coastal sedimentary cap rock areas (<100 mg/kg, HDOH 2009)

AL action level
BERA baseline ecological risk assessment
BIP blow-in-place
C RSL based on carcinogenic endpoint
CAS chemical abstracts service
DE direct exposure (human health)
HDOH Department of Health, State of Hawaii
EAL Environmental Action Level
EPA Environmental Protection Agency
MDL method detection limit
NA not available
NC RSL based on non-carcinogenic endpoint
PQL practical quantitation limit (laboratory specific)
QL quantitation limit
RIX Region IX Pacific Southwest (EPA)
RSL Regional Screening Levels
SW solid waste
WVIA Waikane Valley Impact Area

Matrix: **Soil**

Analytical Group: **Nitroaromatics and Nitroamines** – EPA SW-846 Method 8330

Analyte [b]	CAS No.	Project AL [a] (mg/kg)	Project AL Reference [a]	HDOH EALs (mg/kg)	EPA RIX RSLs (mg/kg)	Project QL Goal (mg/kg)	Laboratory-Specific Limits (mg/kg)	
							PQLs	MDLs
HMX	2691-41-0	770	EAL-DE	770	3,900 [nc]	0.2	0.2	0.04
RDX	121-82-4	5.5	EAL-DE	5.5	5.5 [c]	0.2	0.2	0.04
1,3,5-trinitrobenzene	99-35-4	450	EAL-DE	450	2,200 [nc]	0.2	0.2	0.04
1,3-dinitrobenzene	99-65-0	1.2	EAL-DE	1.2	6.1 [nc]	0.2	0.2	0.04
Nitrobenzene	98-95-3	6.2	EAL-DE	6.2	4.8 [c]	0.2	0.2	0.04
Tetryl (2,4,6-trinitrophenyl-n-methylnitramine)	479-45-8	49	EAL-DE	49	240 [nc]	0.2	0.2	0.066
2,4,6-trinitrotoluene (TNT)	118-96-7	7.2	EAL-DE	7.2	19 [c]	0.2	0.2	0.04
4-amino-2,6-dinitrotoluene	19406-51-0	31	EAL-DE	31	150 [nc]	0.2	0.2	0.063
2-amino-4,6-ditnitrotoluene	35572-78-2	31	EAL-DE	31	150 [nc]	0.2	0.2	0.051
2,4-dinitrotoluene	121-14-2	24	EAL-DE	24	1.6 [c]	0.2	0.2	0.043
2,6-dinitrotoulene	606-20-2	12	EAL-DE	12	61 [nc]	0.2	0.2	0.05
2-nitrotoluene	88-72-2	1.9	EAL-DE	1.9	2.9 [c]	0.4	0.4	0.08
3-nitrotoluene	98-08-1	250	EAL-DE	250	6.1 [nc]	0.4	0.4	0.08
4-nitrotoluene	99-99-0	30	EAL-DE	30	30 [c]	0.4	0.4	0.08

[a] The project action level is derived from the 2009 HDOH EALs for unrestricted land use, threat to drinking water resource, and <150 m from nearest surface water body. In cases where no EAL exists the 2009 EPA Region IX residential RSL is used in place of the EAL. Direct exposure/human health EALs were chosen over terrestrial ecotoxicity based on the result of the BERA (CH2M HILL 2009) indicating that no risk to ecological receptors exists with respect to soil at WVIA.
[b] Analyte applies only to BIP samples.
[c/nc] RSL based on carcinogenic/non-carcinogenic endpoint

HMX tetranitro-1,3,5,7-tetraazocyclooctane
RMX cyclo-1,3,5-trimethylene-2,4,6-trinitramine

15.2 SEDIMENT REFERENCE LIMITS AND EVALUATION TABLE

Matrix: **Sediment**

Analytical Group: **Heavy Metals** – EPA SW-846 Method 6010B, **Mercury** – EPA SW-864 Method 7471A, **Nitroaromatics and Nitroamines** – EPA SW-846 Method 8330

Analyte	CAS No.	Project AL [a] (mg/kg)	Project AL Reference [a]	NOAA SQGs (mg/kg)	EPA RIII BTAG (mg/kg)	Project QL Goal (mg/kg)	Laboratory-Specific Limits (mg/kg)	
							PQLs	*MDLs*
Cobalt	7440-48-4	50	NOAA SQGs	50	50	0.25	0.25	0.2
Copper	7440-50-8	16	NOAA SQGs	16	31.6	0.25	0.25	0.1
Lead	7439-92-1	31	NOAA SQGs	31	35.8	0.25	0.25	0.073
Mercury (elemental)	7439-97-6	0.18	EPA RIII BTAG	0.2	0.18	0.02	0.02	0.0063
RDX	121-82-4	0.013	EPA RIII BTAG	NA	0.013	0.2	0.2	0.04

[a] The project action level is the more conservative value of either the LEL of the NOAA sediment quality guidelines for inorganics in freshwater sediment (SQuiRTs Buchman 2008) or the 2006 EPA Region III BTAG freshwater sediment screening benchmarks.

BTAG biological technical assistance group
LEL lowest effect level
NOAA National Oceanographic and Atmospheric Agency
RIII Region III Mid Atlantic (EPA)
SQG Sediment Quality Guideline
SQuiRTs NOAA screening quick reference tables

Worksheet #16: Project Schedule / Timeline Table

Based on the current project scope of work, the only scheduled activity for this project is the preparation of the SAP. Applicable SAP-related information has been entered on Worksheet #16. Once authorization to proceed with RI implementation has been received, Worksheet #16 will be updated to reflect project-specific activities as well as quality assurance assessments that will be performed during the course of the project.

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	***Anticipated Date of Completion***		
	Refer to Section 10 of the work plan for the project dates.				

Worksheet #17: Sampling Design and Rationale

The intent of this RI is to determine the nature and extent of the hazard/threat presented by MC contamination at WVIA. If sufficient need is documented by site sampling, a human health risk assessment and/or ecological risk assessment (for Waikane Stream only) will be performed, and MC remedies will be evaluated. Its purpose is to augment the data collected during the 2008 SI, and to generate sampling and other field data to determine what further response action or remediation alternatives will be appropriate. The sampling design for this project has been based on the review of historical data including the 2008 SI, site photographs, current site conditions, and accepted sampling rational based on the following guidance documents: *Guidance on Choosing a Sampling Design for Environmental Data Collection* (EPA QA-G5s); MC sampling guidance in the *US Army Corps of Engineers Military Munitions Response Action Engineering Manual* (EM 1110-1-4009), June 2006 and the *US Navy Range Sustainability Environmental Program Assessment Policy Implementation Manual*, December 2003.

The previously conducted SI at the Waikane Valley Impact Area analyzed for nitroaromatics, nitroamines and total metals. No nitroaromatics or nitroamines were detected at concentrations exceeding the project ALs. Two metal compounds, including copper and lead, were detected at concentrations exceeding the project ALs and were identified as COPC. This RI analysis will therefore concentrate on copper and lead in surface soil, subsurface soil and sediment samples. The remaining heavy metals, as well as nitroaromatics and nitroamines will be analyzed for BIP sample analysis only.

Note: The project team verified during the review process that copper and lead are the primary COPCs for the multi-incremental surface soil and discrete subsurface soil investigation whereas blow-in-place samples will also be analyzed for nitroaromatics/nitroamines and additional heavy metals. Composite sediment samples will be analyzed for copper and lead as well as cobalt, mercury and RDX, the COPCs that were identified in surface water samples from Waikane Stream in a U.S. Army Corps of Engineers study (USACE 2009).

17.1 AREAS OF CONCERN

Based on the 2008 SI, five AOCs have been identified at the WVIA, and are depicted in Figures 2 and 3. The five identified AOCs are as follows:

- AOC-1: The most north-western target location
- AOC-2: The western-central target location
- AOC-3: The eastern-central target location
- AOC-4: The south-eastern target location
- AOC-5: Waikane Stream

MI sampling methods were chosen to investigate AOCs 1-4. MI sampling will not be conducted at AOC-5 due to the fact that the Waikane Stream bed consists primarily of medium to large size rocks, with no direct access to the sediment below. Due to the presence of these rocks, the sample collector will need to be biased with regard to sediment sample locations. The major benefits of using MI methods as apposed to using discrete sampling methods are a reduction in sampling error. The largest sources of error overcome through MI sampling procedures are compositional and distributional heterogeneity. Because of the biased nature of sampling the sediment in Waikane Stream, distributional heterogeneity will still be an issue. In addition, due to the high moisture content found in streambed sediments, it will be difficult to determine the volume of sediments needed for MI sample analysis. Based on these factors, composite sampling methods will be employed during the investigation of AOC-5.

17.1.1 Multi-Incremental Sampling Method Summary

The soil sampling program chosen to investigate AOCs 1-4 is a statistical, MI sampling approach that is intended to provide samples representative of the mean concentration of COPC in the five identified AOCs with minimal sampling error. MI sampling is based on a particulate sampling theory that incorporates the relationship that exists between the variability of the soil, the particle sizes in the soil, the distribution of the contaminant in the soil, and the size of the sample taken. One of the benefits of using this method of sampling as apposed to using discrete sampling methods is a reduction in sampling error. The largest sources of error overcome through MI sampling procedures are compositional and distributional heterogeneity. Compositional heterogeneity occurs when not all particles that make up the population within a decision unit have the same concentration of target analytes. This heterogeneity is at a maximum when only a portion of the target analytes is present as discrete particles. Distributional heterogeneity is due to the fact that contaminant particles are scattered across the decision unit unevenly. This error is at a maximum when a single discrete sample is used to characterize an entire decision unit.

17.1.2 Selection of Decision Units

A total of 10 DUs have been selected to investigate AOCs 1-4. It should be noted here that AOCs 1-4 represent the 4 target areas identified during 2008 SI. They were chosen based on the following rationale:

- DU-1: Encompasses the entire AOC-1 boundary, as well as areas downgradient where there is a high potential for MC to have been transported by erosion/runoff during rain events from higher elevations.
- DU-2: Encompasses the northern (upgradient) third of AOC-2. This DU covers areas where high densities of MEC/MD surface debris and subsurface anomalies were detected during the 2008 SI.
- DU-3: Adjacent to the south and downgradient from DU-2. Encompasses the central third of AOC-2. This DU covers areas where high densities of MEC/MD surface debris and subsurface anomalies were detected during the 2008 SI, as well as areas downgradient where there is a high potential for MC to have been transported by erosion/runoff during rain events from higher elevation.
- DU-4: Adjacent to the south and downgradient from DU-3. Encompasses the lower (downgradient) third of AOC-2. This DU covers areas where high densities of MEC/MD surface debris and subsurface anomalies were detected during the 2008 SI, as well as areas downgradient where there is a high potential for MC to have been transported by erosion/runoff during rain events from higher elevation.
- DU-5: Encompasses the northern (upgradient) third of AOC-3. This DU covers areas where high densities of MEC/MD surface debris and subsurface anomalies were detected during

the 2008 SI. In addition, two of the sample locations (MEC042 and MEC043) are located within the boundaries of this DU.

- DU-6: Adjacent to the south and downgradient from DU-5. Encompasses the central third of AOC-3. This DU covers areas where high densities of MEC/MD surface debris and subsurface anomalies were detected during the 2008 SI, as well as areas downgradient where there is a high potential for MC to have been transported by erosion/runoff during rain events from higher elevation.
- DU-7: Adjacent to the south and downgradient from DU-6. Encompasses the lower (downgradient) third of AOC-3. This DU covers areas where high densities of MEC/MD surface debris and subsurface anomalies were detected during the 2008 SI, as well as areas downgradient where there is a high potential for MC to have been transported by erosion/runoff during rain events from higher elevation. In addition, two of the sample locations (MEC019 and MEC020) are located within the boundaries of this DU.
- DU-8: Encompasses the northern (upgradient) third of AOC-4. This DU covers areas where high densities of MEC/MD surface debris and subsurface anomalies were detected during the 2008 SI.
- DU-9: Adjacent to the south and downgradient from DU-8. Encompasses the central third of AOC-4. This DU covers areas where high densities of MEC/MD surface debris and subsurface anomalies were detected during the 2008 SI, as well as areas downgradient where there is a high potential for MC to have been transported by erosion/runoff during rain events from higher elevation.
- DU-10: Adjacent to the south and downgradient from DU-9. Encompasses the lower (downgradient) third of AOC-4. This DU covers areas where high densities of MEC/MD surface debris and subsurface anomalies were detected during the 2008 SI, as well as areas downgradient where there is a high potential for MC to have been transported by erosion/runoff during rain events from higher elevation.

The boundaries of each DU will be established, and marked with stakes or flagging prior to initiating sampling. Each DU will then be sub-divided into 30 squares or rectangular strata (grids). Flagging or steaks will be used to identify the grid spacing. Establishment of irregular shaped grids may be necessary along the outer edges of the DUs to compensate for grid edge effects. Heavy vegetation is expected to be present within all 10 DUs, and will require consideration prior to sampling.

A random number generator will be used to create a random sampling point (x-y coordinate) within each strata. The sampler will then estimate the position within the first strata. The sampler will collect a soil increment from the starting location and then systematically move to the same x-y coordinate within the adjacent strata, continuing across the entire decision unit until one soil increment has been collected from each strata. Soil increments will be collected as follows:

- Remove organic matter deposits from the ground surface
- Using a disposable Encore™ syringe, collect a maximum of 34 grams of soil from a depth not to exceed 6 inches
- Place the soil increment into a pre-labeled 1-gallon Ziplock™ bag
- Move to the next strata and repeat

Care will be taken to yield a similar sample volume at each incremental sample location. Each MI sample shall weigh a minimum of 1-kilogram (kg). After collecting one incremental sample from each grid location, the Ziplock™ bag will be sealed and placed inside of a cooler with ice.

17.1.3 Waikane Stream Sediment Sampling

Composite Sampling methods will be used to investigate COPCs within AOC-5 (Waikane Stream). The portion of Waikane Stream that flows through WVIA will be divided into three equally sized sampling areas referred to as the upstream, midstream, and downstream areas (Figures 2 and 3). From each of these three areas, one composite sediment sample, consisting of 30 increments, will be collected for the COPCs from the stream bed at depths between 0-6 inches bgs.

Each of the evenly sized increments will be placed into a foil lined bowl, and mixed to homogenize the sample. All rocks and organic matter will be removed from the sample. The homogenized sediments will then be placed into the appropriate sample containers using disposable plastic scoops. The foil liner will be replaced between each sample.

17.1.4 Sub-Surface Soil Samples

A total of 10 subsurface sample locations (1 from each DU) will be investigated by collecting two samples from 2 and 3 feet bgs in order to characterize the vertical extent of copper and lead contamination within each of the target area AOCs. A maximum sampling depth of 3 feet was selected since the penetration depth of the munitions previously identified at WVIA is 2 feet bgs. Additionally, although chemicals from MEC items may have leached into the soil, conditions at the site are not conducive to migration of heavy metals contaminants. Hawaiian rains are essentially free of the industrial acids and other chemicals typically associated with dissolving metals in soils, and therefore metals do not migrate easily through subsurface soil.

The number of subsurface soil sample locations was limited to 10, as it is presumed that the soil conditions at the surface are representative of subsurface conditions. This presumption has been made based on the steep gradients at the site, causing surface soils to erode to lower elevations over time. Additionally, Hawaiian rains are essentially free of the industrial acids and other chemicals typically associated with dissolving metals in soils, and therefore metals do not migrate easily through subsurface soil. The 10 subsurface soil sample locations will be investigated to confirm this presumption. This level of uncertainty will be made up for by the MI surface soil results.

Proposed subsurface soil sample locations are depicted in Figures 2 and 3. Sample locations may be subject to change based on the results of the geophysical survey discussed in Section 14.1.2.

17.1.5 BIP Samples

A total of 10 BIP locations will be investigated in order to determine the nature and extent of MC contamination caused by MEC clearance activities. A pre and post BIP sample will be collected at each location at a depth of 0-6 inches bgs, for a total of 20 samples. All BIP samples will be analyzed for total metals and nitroaromatics and nitroamines.

Worksheet #18: Sampling Locations and Methods / SOP Requirements Table

Sampling Location / ID Number	Matrix	Depth (feet bgs)	Analytical Group	Number of Samples (identify field duplicates)	Sampling SOP Reference
AOC 1-4 Target Areas					
A total of 20 discrete subsurface soil samples from 10 sample locations (2 and 3 feet bgs)	Soil	2 and 3	Copper and lead	20 primary, 2 field duplicates, 1 MS/MSD sample, and 1 equipment blank sample; 24 total samples	NAVFAC Procedure ER Program Procedure I-B-1
Three replicate MI soil samples within each of the 10 DUs	Soil	0 to 0.5	Copper and lead	30 replicates; 30 total samples	NAVFAC Procedure ER Program Procedure I-B-1
A total of 20 discrete surface soil samples from 10 BIP locations (0-6 inches bgs).	Soil	0 to 0.5	Heavy metals and nitroaromatics / nitroamines	20 primary, 2 field duplicates, and 1 MS/MSD sample; and 1 equipment blank sample 24 total samples	NAVFAC Procedure ER Program Procedure I-B-1
AOC 5 Waikane Stream					
One composite sample from each of the three sampling areas	Sediment	0 to 0.5	Cobalt, copper, lead, mercury, RDX	3 primary, 1 field duplicate, 1 MS/MSD sample; 5 total samples	NAVFAC Procedure ER Program Procedure I-B-1

AOC	area of concern
bgs	below ground surface
BIP	blow-in-place
DU	decision unit
ER	environmental restoration
ID	identification
MS/MSD	matrix spike / matrix spike duplicate
NAVFAC	Naval Facilities Engineering Command, Pacific
RDX	cyclo-1,3,5-trimethylene-2,4,6-trinitramine
SOP	standard operating procedure

Worksheet #19: Analytical SOP Requirements Table

Matrix	Analytical Group	Analytical and Preparation Method / SOP Reference[a]	Containers (number, size, and type)	Sample volume Analyzed (units)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation / analysis)
Surface Soil	Lead and copper	6010B, L-1, L-3	1-gallon Ziploc bag	1-kilogram	None	180 days
Subsurface Soil	Lead and copper	6010B, L-1, L-3	One 8 ounce jar with Teflon-lined cap[b]	1 gram	None	180 days
Subsurface Soil	% Solids (moisture)	L-2		10 grams[c]	6°C	None
Sediment	Mercury	7471A, L-6	One 8 ounce jar with Teflon-lined cap[b]	0.5 grams	6°C	28 days
Sediment	Lead, cobalt, and copper	6010B, L-1, L-3		1 gram	None	180 days
Sediment	RDX	8330, L-4, L-5		15 grams	Light protected, 6°C	14 days
Sediment	% Solids (moisture)	L-2		10 grams[c]	6°C	None
BIP Surface Soil	Heavy metals	6010B, L1, L-3	One 8 ounce jar with Teflon-lined cap[b]	1 gram	None	180 days
BIP Surface Soil	Nitroamines and nitroaromatics	8330, L-4, L-5		15 grams	Light protected, 6°C	14 days
BIP Surface Soil	% Solids (moisture)	L-2		10 grams[c]	6°C	None

[a] From the analytical SOP references table (Worksheet #23)
[b] One 8-ounce jar will contain enough soil to run each analytical methods
[c] An aliquot of soil for % moisture will be taken from the 8-ounce jar

BIP	blow-in-place
pH	negative logarithm of the molar concentration of dissolved hydrogen ions
RDX	cyclo-1,3,5-trimethylene-2,4,6-trinitramine
SOP	standard operating procedure

Worksheet #20: Field Quality Control Sample Summary Table

Matrix	Analytical Group	No. of Sampling Locations	No. of Field Duplicates / MI Replicates	No. of MS / MSDs	No. of Field Blanks	No. of Equip. Blanks	Total No. of Samples to Lab
Soil - AOC 1-4, Discrete Subsurface	Copper and lead	20 locations	2	1	0	1	24
Soil - AOC 1-4, MI Surface	Copper and lead	10 DUs	3 per DU	0	0	0	30
Sediment - AOC 5, Composite	Cobalt, copper, lead, mercury, RDX	3 areas	1	1	0	0	5
BIP Soil Samples	Heavy metals, nitroaromatics and nitroamines	20 locations	2	1	0	1	24

AOC	area of concern	MS	matrix spike
BIP	blow-in-place	MSD	matrix spike duplicate
DU	decision unit	No.	number
MI	multi-incremental	RDX	cyclo-1,3,5-trimethylene-2,4,6-trinitramine

Worksheet #21: Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment Type	Modified for Project Work? (Y/N)	Comments
S-1	Standard Operating Procedure - MEC Avoidance	USA Environmental, Inc.	N/A	N	Safety precautions for working in areas known or suspected to contain MEC
S-2	Procedure I-B-1, Soil Sampling	NAVFAC Pacific	Disposable plastic scoops and hand auger with slide hammer	N	
S-3	Procedure III-B, Field QC Samples (Soil)	NAVFAC Pacific	N/A	N	
S-4	Procedure III-D, Logbooks	NAVFAC Pacific	N/A	N	
S-5	Procedure III-E, Record Keeping, Sample Labeling, and Chain-of-Custody Procedures	NAVFAC Pacific	N/A	N	
S-6	Procedure III-F, Sample Handling, Storage, and Shipping	NAVFAC Pacific	N/A	N	

Note: SOP S-1 is found in Attachment B. SOPs S-2 to S-6 are found in the *Project Procedures Manual*, US Navy Environmental Restoration Program, NAVFAC Pacific (February 2007) and have been incorporated by reference.

Y	yes
MEC	munitions and explosives of concern
N	no
N/A	not applicable
NAVFAC	Naval Facilities Engineering Command
QC	quality control
SOP	standard operating procedure
TBD	to be determined

Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action	Resp. Person	SOP Reference	Comments
Geophysical and UXO Equipment	Please refer to work plan Section 9.0						

SOP standard operating procedure
UXO unexploded ordnance

Worksheet #23: Analytical SOP References Table

Lab SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work? (Y/N)
L-1	Curtis & Tomkins Standard Operating Procedure - ICP Metals Analysis Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES) Methods EPA 6010 & EPA 200.7 Revision 11, 12 October 2009	Definitive	Heavy Metals	Perkin-Elmer Inductively Coupled Plasma (ICP) Model 4300 DV with Auto sampler	Curtis & Tompkins, Ltd.	N
L-2	Curtis & Tomkins Standard Operating Procedure - Moisture (% Solids) in Soils and Sediment, US EPA CLP Method ILM04.0 Revision 4, 20 April 2008	Definitive	N/A	N/A	Curtis & Tompkins, Ltd.	N
L-3	Curtis & Tomkins Standard Operating Procedure - Acid Digestions of Soil and Solid Samples for Total Metals Analysis by ICP-AES and ICP-MS EPA 3050B Revision 10, 8 February 2010	N/A	Metals	Miscellaneous (refer to the SOP in Attachment C for more information)	Curtis & Tompkins, Ltd.	N
L-4	Curtis & Tompkins Standard Operating Procedure - EPA 8330, Nitroaromatics and Nitroamines Revision 2, 3 November 2009	Definitive	Nitroaromatics and Nitroamines	HPLC with autosampler, Hewett Packard Model 1090 Series 11/L	Curtis & Tompkins, Ltd.	N
L-5	Curtis & Tomkins Standard Operating Procedure - Sonication Bath Extraction (EPA 8330) of Soil Samples for EPA 8330, Nitroaromatics and Nitroamines (Explosives) by HPLC Revision 1, 15 November 2009	N/A	Nitroaromatics and Nitroamines	Sonicator	Curtis & Tompkins, Ltd.	N
L-6	Curtis & Tomkins Standard Operating Procedure – Digestion & Analysis of Solid Samples for Mercury – EPA 7471 Revision 10, 10 September 2009	Definitive	Mercury	Leeman Labs Hydra AA	Curtis & Tompkins, Ltd.	N
L-7	Curtis & Tomkins Standard Operating Procedure - Multi-Incremental Sub-Sampling Revision 2, 28 May 2009	N/A	All	N/A	Curtis & Tompkins, Ltd.	N

ICP inductively coupled plasma
N no
N/A not applicable
SOP standard operating procedure
Y yes

Worksheet #24: Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	CA	Person Responsible for CA	SOP Reference
ICP, CVAA	Five-point initial calibration for all analytes	Daily initial calibration prior to sample analysis	Linear regression correlation - coefficient r > 0.995	Correct problem then repeat initial calibration	Curtis & Tompkins, Ltd.	L-1, L-6
ICP, CVAA	Initial calibration verification (ICV) (second source)	Daily after initial calibration	All analytes within ±10% of true value	Correct problem then repeat initial calibration	Curtis & Tompkins, Ltd.	L-1, L-6
ICP, CVAA	Calibration blank	Before beginning a sample run, after every 10 samples, and at the end of the analysis sequence.	No analytes detected ≥ LOD	Correct problem then analyze calibration blank and previous 10 samples	Curtis & Tompkins, Ltd.	L-1, L-6
ICP, CVAA	Continuing Calibration Verification (CCV) Standard	After every 10 field samples and at the end of the analysis sequence	ICP: All analyte(s) within ±10% of true value CVAA: within ±20% of true value	Repeat calibration and reanalyze all samples since last successful calibration verification	Curtis & Tompkins, Ltd.	L-1, L-6
ICP	Interference check solution (ICS)	At the beginning and end of an analytical run	ICS-A: Absolute value of concentration for all non-spiked analytes less than LOD (with the exception of trace impurities from one of the spiked analytes. ICS-AB: within ±20% of true value.	Terminate analysis; correct problem; reanalyze ICS; reanalyze all affected samples	Curtis & Tompkins, Ltd.	L-1
HPLC	Five-point initial calibration for all analytes	Initial calibration prior to sample analysis	Average response – %RSD for all analytes ≤ 20% Linear – least squares regression r ≥ 0.995	Correct problem then repeat initial calibration	Curtis & Tompkins, Ltd.	L-4
HPLC	Second-source calibration verification for all analytes	Following five-point initial calibration	All analytes within ± 20% of expected value	Correct problem then repeat initial calibration	Curtis & Tompkins, Ltd.	L-4
HPLC	Retention time window calculated for each analyte	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time from 72-hour study, or defaults listed in 8000B	Correct problem then reanalyze all samples analyzed since the last retention time check	Curtis & Tompkins, Ltd.	L-4
HPLC	Calibration Verification	At beginning of each sequence, after every 10 samples and at the end of the sequence	All analytes within ± 20% of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification	Curtis & Tompkins, Ltd.	L-4

CA corrective action
CCV continuing calibration verification
HPLC high performance liquid chromatography
ICP inductively coupled plasma atomic emission spectrometry
ICS-AB interference check standard AB solution
ICV initial calibration verification
SOP standard operating procedure

Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument / Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference [a]
ICP	Replenish rinse water reservoir	none	Add water	Daily	See L-1	See L-1	Curtis & Tompkins, Ltd.	L-1
ICP	Change pump windings for internal standard solution	none	Replace windings	Every one or two days	See L-1	See L-1	Curtis & Tompkins, Ltd.	L-1
ICP	Change sampling tube	none	Replace tubing	Every week or two or when bubbles appear	See L-1	See L-1	Curtis & Tompkins, Ltd.	L-1
ICP	The torch and injector should be changed and cleaned	none	Immerse the parts in aqua regia overnight	Whenever the torch alignment intensity drops by 20%	See L-1	See L-1	Curtis & Tompkins, Ltd.	L-1
CVAA	Replace pump windings	None	Visually inspect	Whenever cracked or leaking	None	Replace pump windings	Curtis & Tompkins, Ltd.	L-6
CVAA	Clean drying tube	None	Visually inspect	When glass begins to turn yellow	None	Sonicate in 1:1 nitric acid/DI water for 30 minutes	Curtis & Tompkins, Ltd.	L-6
CVAA	Clean gas-liquid separator	None	Visually inspect	When cell appears smudged or dirty	None	Clean with spectrophotometric grade IPA	Curtis & Tompkins, Ltd.	L-6
CVAA	Replace lamp	None	Check voltage	Daily	None	Order lamp when voltage is at 10mV, replace when voltage reaches 15mV	Curtis & Tompkins, Ltd.	L-6
HPLC	Degas the solvents	None	Fill reservoir, connect to instrument, turn on Degas knob for 15 minutes	Before use	See L-4	See L-4	Curtis & Tompkins, Ltd.	L-4
HPLC	Condition the system after Idle/Standby	None	Inject one or two high Nitroamine or Nitroaromatic standards before starting	When the system has not been used for a few days	See L-4	See L-4	Curtis & Tompkins, Ltd.	L-4
HPLC	Equilibrate the column	None	Flush column with 50/50% water/ methanol for 2-3 hr. Set oven temp to 40-45^{o}C. Analyze two solvent blanks and two CCVs.	If retention time drifts or compounds elute in a shorter time than expected	See L-4	See L-4	Curtis & Tompkins, Ltd.	L-4

[a] From the analytical SOP references table (Worksheet #23).

The laboratory is responsible for inspecting and maintaining laboratory equipment as described in their laboratory quality assurance plan (as specified by the analytical method used) and as described in the *Department of Defense Quality Systems Manual for Environmental Laboratories*, January 2006. The primary laboratory for this project is Curtis & Tompkins, Ltd. which is accredited through the DoD ELAP since December 2009.

HPLC	high performance liquid chromatography	ICP	inductively coupled plasma	SOP	standard operating procedure

Worksheet #26: Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel / Organization): Sample Team Leader / Wil Chee - Planning, Inc.
Sample Packaging (Personnel / Organization): Sample Team Leader / Wil Chee - Planning, Inc.
Coordination of Shipment (Personnel / Organization): Sample Team Leader / Wil Chee - Planning, Inc.
Type of Shipment / Carrier: Coolers / FedEx
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel / Organization): Sample Control / Curtis & Tompkins, Ltd.
Sample Custody and Storage (Personnel / Organization): Sample Control / Curtis & Tompkins, Ltd.
Sample Preparation (Personnel / Organization): Preparation Chemist / Curtis & Tompkins, Ltd.
Sample Determinative Analysis (Personnel / Organization): Analytical Chemist / Curtis & Tompkins, Ltd.
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): 60 days
Sample Extract / Digestate Storage (No. of days from extraction / digestion): 90 days or until they expire
Biological Sample Storage (No. of days from sample collection): Not applicable
SAMPLE DISPOSAL
Personnel / Organization: Sample Control / Curtis & Tompkins, Ltd.
Number of Days from Analysis: 60 days

Worksheet #27: Sample Custody Requirements

This worksheet describes the procedures that will be used to maintain sample custody and integrity.

27.1 FIELD SAMPLE CUSTODY PROCEDURES

Sample collection, packaging, shipment, and delivery to laboratory

A field logbook will be maintained during the field inspection to provide a primary record of field activities. Entries will be made chronologically and in sufficient detail to allow the writer or knowledgeable reviewer to reconstruct the applicable events. Entries will include the time and location of each activity, descriptions of any general problem encountered and its resolution, requested changes in activity, and impacts to work schedule. The logbook will include the signature of the individual responsible for the entries contained in the logbook.

A unique sample number will be assigned to each sample to facilitate data tracking and storage. Field personnel will log individual samples onto chain-of-custody (COC) forms in accordance with NAVFAC Pacific ER Program Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON 2007). Information required on these forms includes sample number, matrix, date and time of collection, number of containers, analytical methods to be performed on the sample, and preservatives (if any). The COC form will accompany the samples from the field to the laboratory (additional details appear in the COC Procedures section below). The sampler will sign the COC form signifying that they were the person who collected the samples. The person delivering the samples to the airfreight company for transport to the laboratory will also sign and date the COC form.

A sample label with adhesive backing will be affixed to each individual sample container. The sample number, date and time of collection, sampler's initials, preservative (if applicable), and analysis to be performed on the sample will be recorded on each label with a waterproof marker. Clear tape will be placed over each label to prevent the label from tearing, falling off, smearing, and to otherwise prevent loss of information on the label.

After being labeled, all sample containers will be placed in insulated coolers. Samples will be stored in accordance with NAVFAC Pacific ER Program Procedure III-F, *Sample Handling, Storage, and Shipping Procedures* (DON 2007) prior to shipping. Cushioning material will be placed on the bottom and top (and optionally on the sides) of the inside of the cooler as needed. Empty space between sample containers will be filled with appropriate material. Glass sample containers will be wrapped with bubble wrap or other appropriate padding to prevent breakage during transport. Frozen gel packs or ice in double, sealed self-sealing bags will be placed in the coolers with samples that must be maintained at <6 degrees Celsius (°C). Prior to shipment to the analytical laboratory, the ice or cold packs in coolers will be replaced to allow samples to be maintained at <6 °C until received by the laboratory.

All samples will be shipped to the analytical laboratory via express courier. When a cooler is ready for shipment to the laboratory, two copies of the COC form will be placed inside a self-sealing bag and taped to the inside of the cooler lid. The coolers will then be sealed with waterproof tape and any required labels attached.

Shipment of soil samples to continental United States from Hawaii is controlled by the United States Department of Agriculture (USDA) and is subject to their inspection and regulation. Documentation in the form of a "USDA Soil Import Permit" is required to prove that the receiving laboratory is certified by the USDA to receive and properly dispose of foreign soil. In Hawaii, soil sample shipments are typically brought to the air freight courier at the airport where a USDA representative is contacted by the courier to make an inspection. During the inspection, sample coolers are inspected, affixed with a label indicating that the coolers contain environmental samples, and the shipping forms stamped with approval. Alternatively, WCP has received approval from the USDA to ship soil samples from Hawaii and has received a stamp that is placed on the shipping paperwork to facilitate shipment. In this way, the USDA does not need to inspect each soil sample shipment, although they have the authority and option to do so.

Custody seals will be placed on the coolers. The seals will be placed in such a manner that they must be broken to open the coolers in order to enable detection of sample tampering. The custody seals will be labeled with the sampler's name or initials, and date and time that the sample/cooler was sealed.

The air freight bill, laboratory soil import permit, address labels, and soil import permit labels (optional), will be attached to the outside of the coolers. If a shipment is made up of multiple pieces (e.g., more than one cooler), the paperwork will be attached only to one cooler, if the courier agrees. However, all other coolers in the shipment will have an address label and custody seals affixed.

Copies of the COC(s) and air fright bill will be emailed or faxed to the laboratory to inform them of the pending shipment.

A sample custody seal and chain-of-custody form are presented in Attachment B.

27.2 LABORATORY SAMPLE CUSTODY PROCEDURES

Receipt of samples, archiving, disposal

A designated sample custodian will take custody of all samples upon their arrival at the Curtis & Tomkins analytical laboratory in Berkeley, California. The custodian will sign and retain copies of the airway bills and COC forms. The custodian will inspect all sample labels and COC forms to ensure that the information is consistent, and that each is properly completed. The custodian will also measure the temperature of the samples in the coolers upon arrival. The custodian will also document if any of the following conditions:

- If the samples show signs of damage or tampering
- If the containers are broken or leaking
- If any sample holding times have been exceeded

The sample custodian will document all of the above information on the sample receipt sheet.

In the event that a sample container breaks in shipment, or if discrepancies are noted between the COC form, sample labels, or requested analysis, the laboratory sample custodian will immediately notify the Field Manager and Project Geologist. A non-conformance report will be completed within 24 hours. At the time of notification, appropriate corrective action will be determined. The sample custodian will enter the corrective action into the laboratory system, and a log-in confirmation sheet will be sent within 48 hours to the Field Manager and Project Geologist.

The custodian will then assign a unique laboratory number to each sample and distribute the samples to secured storage areas, including those samples that must be maintained at <6°C. The unique laboratory number for each sample, the client name, date and time received, analysis due date, and storage will also be manually logged onto a sample receipt record and later entered into the laboratory's computerized data management system.

Laboratory personnel will be responsible for the care and custody of samples from the time of their receipt at the laboratory through their exhaustion or disposal. Samples should be logged in and out on internal laboratory chain-of-custody forms each time they are removed from storage for extraction or analysis.

27.3 SAMPLE IDENTIFICATION PROCEDURES

Each sample will be assigned both a COC sample number and a descriptive identification (ID) number in accordance with NAVFAC Pacific ER Program Procedure I-A-8, *Sample Naming* (DON 2007). All sample ID numbers will be recorded in a sample logbook maintained by field personnel. The COC sample number will have the following format to facilitate data tracking and storage, and will start with WVI001:

WVIAyyy

where WVIA refers to the Waikane Valley Impact Area, and

yyy is a chronological number, starting with 001

For example, the sample number for the 30th sample would be WVIA030. QC samples will be included in the chronological sequence.

A sample label with adhesive backing will be affixed to each individual sample container. Clear tape will be placed over each label to prevent the labels from tearing off, falling off, being smeared, and to prevent loss of information on the label.

27.4 CHAIN-OF-CUSTODY PROCEDURES

Field personnel will log individual samples onto COC forms in accordance with NAVFAC Pacific ER Program Procedure III-E, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* (DON 2007). Completing a COC form initiates the documentation of the process of custody control, which includes possession of a sample from the time of its collection in the field to its receipt by the analytical laboratory. These forms may also serve as the request for analyses. Information required on the COC forms includes the sample number, matrix, date and time of collection, number of containers, analytical methods to be performed on the sample, and preservatives (if any).

The sampler will sign the COC form signifying that they were the person who collected the samples. The sampler will retain one copy of the COC form and the remaining copies of the COC form will be placed inside a self-sealing bag and taped to the inside of the cooler containing the samples. Each cooler will be associated with a unique COC form. When a transfer of custody takes place, both parties will sign and date the accompanying copy COC forms, and the individual relinquishing the samples will retain a copy of each form. One exception is when the samples are shipped; air freight courier personnel will not sign or receive a copy because they do not open the coolers. The laboratory will attach copies of the completed COC forms to the data packages containing the results of the analytical tests.

The original COC form will be submitted by the laboratory along with the data delivered. Any changes to the analytical requests that are required will be made in writing to the laboratory. A copy of this written change and the reason for the change will be included in the project files so that recurring problems can be easily identified. Following the completion of sampling activities, the COC forms will be transmitted to the Project Manager for storage in project files.

A Sample Custody Flow Diagram has been included in as in Attachment B.

Worksheet #28: Laboratory QC Samples Table

28.1 Laboratory QC Samples Table – ICP Metals

Matrix	Soil and Sediment
Analytical Group	Total Metals
Analytical Method / SOP Reference	6010B

QC Sample	Frequency & Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria [a]
Sub-sampling triplicate	One per MI sample	6010B / L-1	None	Curtis & Tompkins, Ltd.	Accuracy	RSD ≤ 20%
Matrix spike	One per matrix per analytical method for each batch of at most 20 samples	6010B / L-1	None	Curtis & Tompkins, Ltd.	Accuracy / Bias	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS (QSM 4.1)
Matrix spike duplicate	One per matrix per analytical method for each batch of at most 20 samples	6010B / L-1 RPD ≤ 20%	Contact client	Curtis & Tompkins, Ltd.	Precision	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS (QSM 4.1)
Method blank	One per matrix per analytical method for each batch of at most 20 samples	6010B / L-1	Redigest and reanalyze	Curtis & Tompkins, Ltd.	Accuracy / Bias / Representativeness	All target analytes ≤ ½ laboratory RL (unless all sample results are 10x blank level. Common lab contaminants < RL
Laboratory control sample	One per digestion batch	6010B / L-1	Correct problem then re-prep and reanalyze the LCS and all samples in the affected batch	Curtis & Tompkins, Ltd.	Accuracy / Bias	QC acceptance criteria specified by DoD (QSM 4.1 D-3 or Appendix G)
Internal standards	Each sample	6010B / L-1	Check instrument performance, reanalyze and qualify data.	Curtis & Tompkins, Ltd.	Precision / Accuracy / Bias	Area counts -50% to +100% of initial calibration internal standards or continuing calibration internal standard area counts; Retention times +/- 30 secs of continuing calibration
Post-digestion spike	When dilution test fails or analyte concentration in all samples < 50 LOD	6010B / L-1	Qualify data	Curtis & Tompkins, Ltd.	Accuracy / Bias	Recovery 75-125%
ICP Serial dilution	Per analytical run	6010B / L-1	Qualify data	Curtis & Tompkins, Ltd.	Accuracy / Bias	%Difference 90-110

[a] The MPC for laboratory control samples and surrogate spikes are within the control limits specified in the *Department of Defense Quality Systems Manual (DoD QSM) for Environmental Laboratories* Version 4.1 (DoD 2009). MS/MSD will be evaluated against the same MPC as the LCS in order to evaluate matrix interference (DoD QSM 4.1 2009).

%	percent	LOD	limit of determination (QSM 4.1)	QC	quality control
DQI	data quality indicator	MI	multi-incremental	RPD	relative percent difference
ICP	inductively coupled plasma	MPC	measurement performance criteria	RSD	relative standard deviation
LCS	laboratory control sample	MS/MSD	matrix spike duplicate	SOP	standard operating procedure

28.2 LABORATORY QC SAMPLES TABLE – NITROAROMATICS AND NITROAMINES

Matrix	Soil and Sediment
Analytical Group	Nitroaromatics and Nitroamines
Analytical Method / SOP Reference	8330

QC Sample	Frequency & Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria [a]
Matrix spike	One per every 20 project samples	8330 / L-4	None	Curtis & Tompkins, Ltd.	Accuracy / Bias	For matrix evaluation, use LCS acceptance criteria specified by DoD, otherwise use in-house LCS control limits (QSM 4.1)
Matrix spike duplicate	One per every 20 project samples	8330 / L-4	None	Curtis & Tompkins, Ltd.	Precision	For matrix evaluation, use LCS acceptance criteria specified by DoD, otherwise use in-house LCS control limits (QSM 4.1)
Method blank	1 per extraction batch (up to 20 samples)	8330 / L-4	Correct problem then reextract and reanalyze method blank and all samples in the affected batch	Curtis & Tompkins, Ltd.	Accuracy / Bias / contamination	All target analytes $\leq$ ½ QL
Surrogate spike	Every sample, spiked sample, standard and MS/MSD	8330 / L-4	Correct problem then reextract and reanalyze sample	Curtis & Tompkins, Ltd.	Accuracy / Bias / Lab	QC acceptance criteria specified by DoD, otherwise use in-house control limits
Lab control sample	1 per extraction batch (up to 20 samples)	8330 / L-4	Correct problem the reextract and reanalyze the LCS and all samples in the affected batch	Curtis & Tompkins, Ltd.	Accuracy / Bias	QC acceptance criteria specified by DoD, otherwise use in-house control limits (< 3x standard deviation of mean LCS recovery) (QSM 4.1 D-3 or Appendix G)
Second-column confirmation	100% for all positive results	8330 / L-4	None	Curtis & Tompkins, Ltd.	Comparability	RPD between columns $\leq$ 40%

[a] The MPC for laboratory control samples and surrogate spikes are within the control limits specified in the *Department of Defense Quality Systems Manual (DoD QSM) for Environmental Laboratories* Version 4.1 (DoD 2009). MS/MSD will be evaluated against the same MPC as the LCS in order to evaluate matrix interference (DoD QSM 4.1 2009).

28.3 LABORATORY QC SAMPLES TABLE – MERCURY

Matrix	Sediment
Analytical Group	Mercury
Analytical Method / SOP Reference	7471

QC Sample	Frequency & Number	Method / SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	DQI	Measurement Performance Criteria [a]
Matrix spike	One per matrix per analytical method for each batch of at most 20 samples	7471 / L-6	None	Curtis & Tompkins, LTD.	Accuracy / Bias	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS (QSM 4.1)
Matrix spike duplicate	One per matrix per analytical method for each batch of at most 20 samples	7471 / L-6 RPD ≤ 20%	Contact client	Curtis & Tompkins, LTD.	Precision	For matrix evaluation, use QC acceptance criteria specified by DoD for LCS (QSM 4.1)
Method blank	One per matrix per analytical method for each batch of at most 20 samples	7471 / L-6	Redigest and reanalyze	Curtis & Tompkins, LTD.	Accuracy/Bias, Representativeness	All target analytes ≤ ½ laboratory QL
Laboratory control sample	One per digestion batch	7471 / L-6	Correct problem then re-prep and reanalyze the MS and all samples in the affected batch	Curtis & Tompkins, LTD.	Accuracy / Bias	QC acceptance criteria specified by DoD (QSM 4.1 D-3 or Appendix G)
Post-digestion spike	For compounds outside of quality control limits in matrix spike	7471 / L-6	Qualify data	Curtis & Tompkins, LTD.	Accuracy / Bias	Recovery 75-125%
ICP Serial dilution	Per analytical run	7471 / L-6	Qualify data	Curtis & Tompkins, LTD.	Accuracy / Bias	%Difference 90-110

[a] The MPC for laboratory control samples and surrogate spikes are within the control limits specified in the *Department of Defense Quality Systems Manual (DoD QSM) for Environmental Laboratories* Version 4.1 (DoD 2009). MS/MSD will be evaluated against the same MPC as the LCS in order to evaluate matrix interference (DoD QSM 4.1 2009).

Worksheet #29: Project Documents and Records Table

Document	Where Maintained
Sample Collection Documents and Records	Copies of all documents will be kept at the USA Environmental, Inc. Tampa, FL office 720 Brooker Creek Blvd. Ste. 204 Oldsmar, FL 34677 Tel.: (813) 343-6336 Fax: (813) 343-6337
Final RI work plan	
Final RI Sampling and Analysis Plan (Appendix to WP)	
Field Logbook	
Sampling notes and log	
Chain-of-custody records	
Airbills	
Documentation of any corrective actions taken	
All other field documentation	
Field equipment calibration logs	
Offsite Analysis Documents and Records	
Sample receipt and chain-of-custody forms	
Equipment calibration, maintenance, testing, and inspection logs	
Sample preparation and run logs	
Corrective Action forms, if any	
Telephone logs	
Field sample results, laboratory standards	
Laboratory standards, QC checks, and QC sample results	
Laboratory instrument calibration logs and forms	
Instrument printouts (raw data) for the field and laboratory QC samples	
Extraction / cleanup records	
Full analytical data packages and electronic data deliverables	
Data Assessment Documents and Records	
Data validation reports	
Data quality assessment report	
Telephone logs	
Field audit report	
Field documentation assessment	
Laboratory assessment	
NEDD/NIRIS deliverables	
QA report on deliverables	
Corrective action forms, if any	
Final RI/FS Report	

Worksheet #30: Analytical Services Table

Matrix	Analytical Group(s)	Sample Locations / ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory / Organization [a] (name and address, contact person, and telephone number)	Backup Laboratory / Organization (name and address, contact person, and telephone number)
Soil	Heavy metals (copper and lead)	All 10 DUs (MI sampling) and all 20 subsurface sampling location (discrete sampling)	L-1, L-2, L-3, L-6, L-7	21 Days	Curtis & Tompkins, LTD. 2323 5th St. Berkeley, CA 94710 John Goyette (510) 204-2233	Agriculture & Priority Pollutants Laboratories, Inc. (APPL) 908 N Temperance Ave. Clovis, CA 93611 (559) 275-2175
Soil	Nitroaromatics and nitroamines	BIP sample locations only	L-4 and L-5	21 Days	Curtis & Tompkins, LTD. 2323 5th St. Berkeley, CA 94710 John Goyette (510) 204-2233	Agriculture & Priority Pollutants Laboratories, Inc. (APPL) 908 N Temperance Ave. Clovis, CA 93611 (559) 275-2175
Sediment	Heavy metals (cobalt, copper, lead), mercury, RDX	All 3 sampling areas (composite sampling)	L-1 through L-7	21 Days	Curtis & Tompkins, LTD. 2323 5th St. Berkeley, CA 94710 John Goyette (510) 204-2233	Agriculture & Priority Pollutants Laboratories, Inc. (APPL) 908 N Temperance Ave. Clovis, CA 93611 (559) 275-2175

[A] Effective October 1, 2009, laboratories performing work in support of the Navy Environmental Restoration Program must be accredited through the DoD ELAP.

BIP	blow-in-place	MI	multi-incremental
DU	decision unit	RDX	cyclo-1,3,5-trimethylene-2,4,6-trinitramine
ID	identification	SOP	standard operating procedure

Worksheet #31: Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (title and organizational affiliation)	Person(s) Responsible for Responding to Assessment Findings (title and organizational affiliation)	Person(s) Responsible for Identifying and Implementing CA (title and organizational affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (title and organizational affiliation)
Laboratory Data Assessment/ Data Validation	Once	External	LDC	Third Party Validators (LDC)	Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc.	Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc.	Derek Yasaka, Senior Manager, Wil Chee - Planning, Inc.
Field logbooks	Weekly	Internal	Wil Chee - Planning, Inc.	Derek Yasaka, Senior Manager, Wil Chee - Planning, Inc.	Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc.	Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc.	Derek Yasaka, Senior Manager, Wil Chee - Planning, Inc.
Field audit	Once at the start of sampling	Internal	Wil Chee - Planning, Inc.	Derek Yasaka, Senior Manager, Wil Chee - Planning, Inc.	Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc.	Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc.	Derek Yasaka, Senior Manager, Wil Chee - Planning, Inc.

CA corrective action
LDC Laboratory Data Consultants, Inc.

Worksheet #32: Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings	Time Frame of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response	Time Frame for Response
Field logbooks	Memorandum	Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc. Derek Yasaka, Senior Project Manager, Wil Chee - Planning, Inc.	2 working days	Memorandum	Derek Yasaka, Senior Project Manager, Wil Chee - Planning, Inc. Clayton Sugimoto, Field Manager, Wil Chee -Planning, Inc. RPM, NAVFAC Pacific	2 working days
Field audit	Audit Report	Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc. Derek Yasaka, Senior Project Manager, Wil Chee - Planning, Inc.	24 hours after audit	Letter	Clayton Sugimoto, Field Manager, Wil Chee -Planning, Inc. Derek Yasaka, Senior Project Manager, Wil Chee - Planning, Inc. Bob Nore, Project Manager, USA Environmental RPM, NAVFAC Pacific	24 hours after notification

NAVFAC Naval Facilities Engineering Command
RPM remedial project manager

Worksheet #33: Quality Assurance Management Reports Table

Type of Report	Frequency	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation	Report Recipient(s)
Third Party Data Validator Report	Once after all data is generated	30 days after received	LDC	Derek Yasaka, Project Manager, Wil Chee - Planning, Inc. Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc. Lance Higa, Program Manager, NAVFAC Pacific
Final Audit Report	Once, at start of sampling	During the first week of field sampling	Derek Yasaka, Project Manager, Wil Chee - Planning, Inc.	Derek Yasaka, Project Manager, Wil Chee - Planning, Inc. Clayton Sugimoto, Field Manager, Wil Chee - Planning, Inc.
Final RI/FS Report	Once, after data validation is complete	Refer to Worksheet #16	Bob Nore, Project Manager, USA Environmental, Inc.	Lance Higa, Program Manager, NAVFAC Pacific

CTO	Contract Task Order	QA	quality assurance
LDC	Laboratory Data Consultants, Inc.	QC	quality control
NAVFAC	Naval Facilities Engineering Command	RPM	Remedial Project Manager
NAVFAC ESC	Naval Facilities Engineering Service Center	TBD	to be determined

Worksheet #34: Verification (Step I) Process Table

Verification Input	Description	Internal / External	Responsible for Verification
Chain-of-Custody Forms	COC forms will be reviewed internally upon their completion and verified against the packed sample coolers they represent. A copy of each COC will be placed in the project files. The original COC will be taped inside the cooler for shipment to the analytical laboratory.	Internal	Christin Shacat, Project Geologist, Wil Chee - Planning, Inc.
Sampling Audit Reports	A copy of all audit reports will be placed in the project files. Copies of documented corrective action taken will be attached to the appropriate audit report. Upon completion of site work, the audit reports will be reviewed to ensure that all appropriate corrective actions have been taken and that corrective action reports are attached.	Internal	Christin Shacat, Project Geologist, Wil Chee - Planning, Inc.
Field Notes	Field notes will be reviewed internally and placed in the project file. Copies of the field notes will be included in the final report as needed.	Internal	Clayton Sugimoto, Field Manager, and Christin Shacat, Project Geologist, Wil Chee -Planning, Inc.
Sampling Analytical Data Package	All analytical data packages will be verified internally by the laboratory performing the work for completeness prior to submittal.	Internal	John Goyette, Curtis & Tompkins, Ltd.
	All analytical data packages will be verified externally according to the data validation procedures specified in Worksheet #36.	External	Laboratory Data Consultants, Inc.

COC chain-of-custody
SOP standard operating procedure

Worksheet #35: Validation (Steps IIa and IIb) Process Table

Step IIa / IIb1	Validation Input	Description	Responsible for Validation
IIa	Analytes	Determine whether all analytes specified in Worksheet #15 were analyzed and reported by the laboratory.	Christin Shacat, Project Geologist, Wil Chee - Planning, Inc.
IIa	Data Validation Report and Data Qualifiers	Assess and document the performance of the analytical process in accordance with Section II of the NAVFAC Pacific ER Program Project Procedures \(DON 2007). Summarize deviations from analytical methods, procedures or contract limits. Qualify analytical data and include an explanation of data qualifiers.	Laboratory Data Consultants, Inc.
IIb	Sampling Plan	Determine whether the number and type of soil and sediment samples specified in Worksheet #20 were collected and analyzed.	Christin Shacat, Project Geologist, Wil Chee - Planning, Inc.
IIb	Field QC Samples	Establish that the number of QC samples specified in Worksheet #20 were collected and analyzed.	Christin Shacat, Project Geologist, Wil Chee - Planning, Inc.
IIb	Project Quantitation Limits	Establish that sample results met the project quantitation limits, qualify the data in accordance with NAVFAC Pacific ER Program Procedure II-A, *Data Validation Procedure*	Laboratory Data Consultants, Inc.

IIa=compliance with methods, procedures, and contracts (see Table 10, page 117, UFP-SAP Manual, V.1, March 2005)
IIb=comparison with measurement performance criteria in the SAP (see Table 11, page 118, UFP-SAP Manual, V.1, March 2005)
ER environmental restoration
NAVFAC Naval Facilities Engineering Command
QC quality control
TBD to be determined

Worksheet #36: Validation (Steps IIa and IIb) Summary Table

Step IIa / IIb	Matrix	Analytical Group	Validation Criteria	Data Validator
IIa	Soil	All	Check compliance with sampling methods and procedures as specified in NAVFAC Pacific ER Program Project Procedures (DON 2007) and as specified in Worksheet #21. Evaluate any deviations from the SAP.	Laboratory Data Consultants, Inc.
IIb	Soil	All	10% at NAVFAC Pacific Full Validation and 90% at NAVFAC Pacific Standard Validation: Procedure II-A, *Data Validation Procedure* Procedure II-Q, *Standard and Full Data Validation Procedure for Metals by SW-846 6000 / 7000* Procedure II-S, *Data Quality Assessment Report Procedure* Compare with the measurement performance criteria specified in Worksheet #12.	Laboratory Data Consultants, Inc. and Christin Shacat, Project Geologist, Wil Chee - Planning, Inc.

IIa compliance with methods, procedures, and contracts (see Table 10, page 117, UFP-SAP Manual, V.1, March 2005)
IIb comparison with measurement performance criteria in the SAP (see Table 11, page 118, UFP-SAP Manual, V.1, March 2005)
ER environmental restoration
NAVFAC Naval Facilities Engineering Command

Worksheet #37: Usability Assessment

Following verification and validation of all analytical data, a usability assessment will be performed by the key members of the project team, including the Project Manager, Risk Assessor, Field Manager, Project Geologist, and NAFAC Pacific personnel. The usability assessment will be performed to compare how well the collected data support the project objectives. The results of the usability assessment will be reviewed by the NAVFAC Pacific RPM and QA Chemist to determine whether the data can be used to answer the principle study questions. The RI/FS Report will include discussions of conclusions drawn and any limitations on the use of project data as a result of this assessment.

The usability of data collected during this RI will be assessed in the following ways:

1. First, any deviations from proposed field activities and handling procedures will be reviewed, and their effect on data usability evaluated;
2. Second, the analytical results of the soil sampling will be compared to the PQOs presented on Worksheets #12 and #28 to determine whether the MPC were met; and
3. Finally, upon completion of the verification and validation processes noted on Worksheet #34 and Worksheet #35, the data quality indicators will be evaluated for each analytical group and, based on the results of this examination, conclusions regarding the validity and usability of data for each analytical group will be drawn.

A DQA Report will be prepared by the validation subcontractor in accordance with the NAVFAC Pacific ER *DQA Report Procedure* (DON 2007). Overall measurement error (sampling plus analytical) will be assessed as noted below. The RI/FS Report will include discussions of conclusions drawn and any limitations on the use of project data as a result of this assessment.

Error associated with sampling and laboratory analysis of the collected samples includes the following parameters**:**

Precision – Sampling and analytical precision will be evaluated by calculating the relative percent difference (RPD) for each set of sample duplicates and comparing the results to the MPCs in Worksheet #12. Analytical precision will be evaluated by calculating the RPD for MS/MSD and/or internal laboratory duplicates and comparing the values to the MPC in Worksheet #28.

Accuracy / Bias Contamination – The analytical results for laboratory method blanks will be checked against the MPC in #28 to evaluate possible contaminants.

Overall Accuracy / Bias – Laboratory control samples (LCSs) determine how accurately the laboratory can analyze for analytes using the selected method in the absence of matrix interferences. MSs demonstrate the accuracy of the laboratory sample preparation and analysis in the possible presence of matrix interferences. For all EPA Methods, accuracy / bias will be assessed by reviewing the percent recovery of LCSs and MSs and comparing them to the MPC in Worksheet #28.

Sensitivity – Sensitivity assesses the ability of the laboratory to detect target analytes using the methods and instruments selected for this project. Worksheet #15 lists the project ALs and laboratory detection limits. Based on laboratory MDL studies, the EPA methods and laboratory instrumentation selected for use on this project are more than adequate to detect all target analytes at the project ALs.

Representativeness – Representativeness is a qualitative parameter that expresses the degree to which data accurately and precisely represent the population and/or environmental conditions at the project site. It is evaluated by reviewing the QC results of blank samples and holding times. Positive detects of compounds in the field blank, equipment blank, and trip blank samples identify compounds that may have been introduced into the samples during sample collection, transport, preparation, or analysis.

Comparability – Comparability on this project requires the normalization of data to standard conditions, such as requiring results to be reported in appropriate units and by employing EPA methods of analysis.

Completeness – Once all analytical data have been validated, a completeness check will be performed on the data and the results compared to the MPC on Worksheet #12. Completeness will be assessed for the field sampling effort by dividing the total number of samples collected by the total number of samples proposed on Worksheet #20. Completeness will also be assessed for each target analyte as percent usable data (number of usable results divided by the total number of samples analyzed).

Uncertainty of Reporting Limits – The magnitude of laboratory reporting limits (RLs) will affect the results of environmental investigations. It is possible that a COPC is present in the environmental media at concentrations below the laboratory's RL but above the screening criteria. As such, an assumption that the COPC is not present would potentially result in an underestimation of the potential contamination. In this case, the COPC should not be eliminated from the COPC list without further evaluation. For this RI, the laboratory RLs listed in Worksheet #15 may not be achievable in individual samples for any of the following reasons:

- When analytes are present in the sample at greater than approximately 5 times the QL, dilutions may be necessary, resulting in elevated RLs for other target analytes. The laboratory will report both the diluted and undiluted sample results to allow data validators to accept the lower RLs analytes not detected from the undiluted sample.
- If matrix problems occur, dilutions may be necessary and the listed RLs may not be met for each sample for each analyte.

Attachment A
Figures

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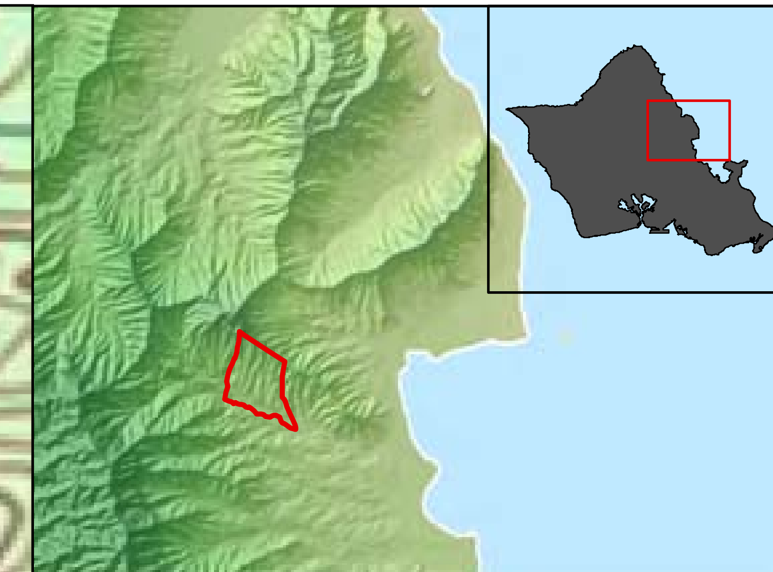


Legend

- Decision Units
- Waikane Stream Sampling Areas
- Waikane Project Boundary
- Subsurface Sample Location
- Waikane Stream

N

860 430 0 860 Feet

1:6,200

Figure 1
Site Map

Waikane Valley Impact Area
Remedial Investigation / Feasibility Study

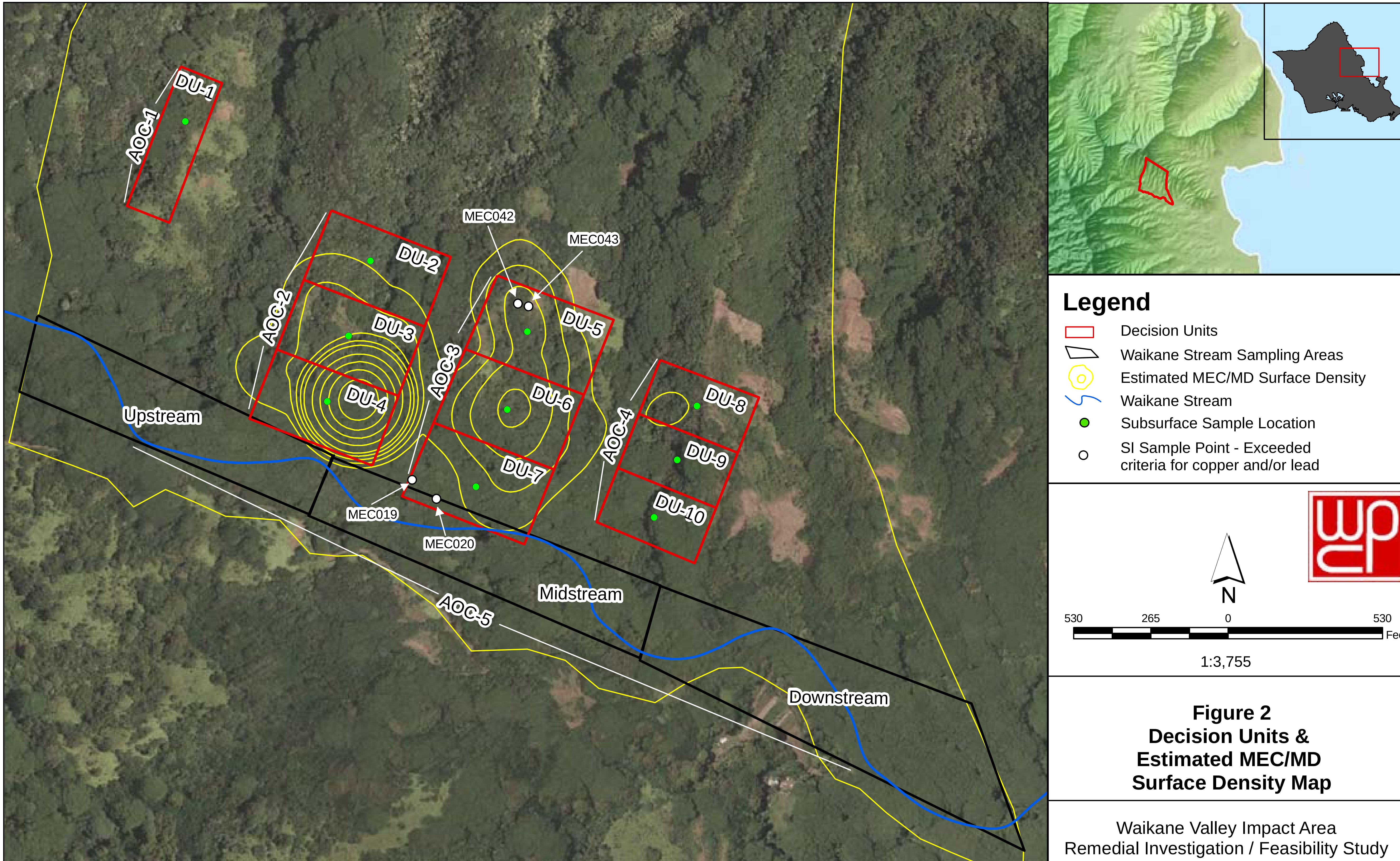
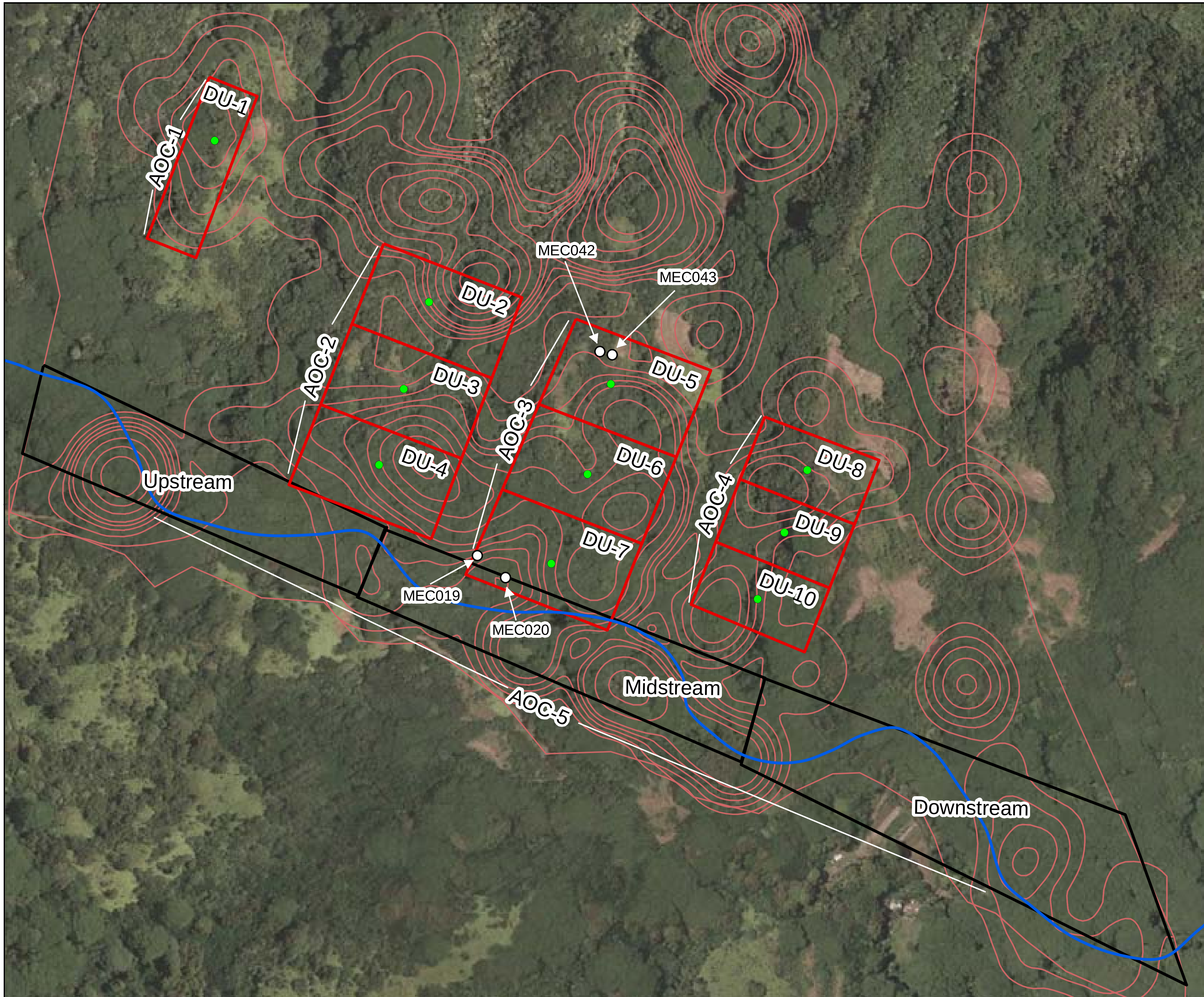
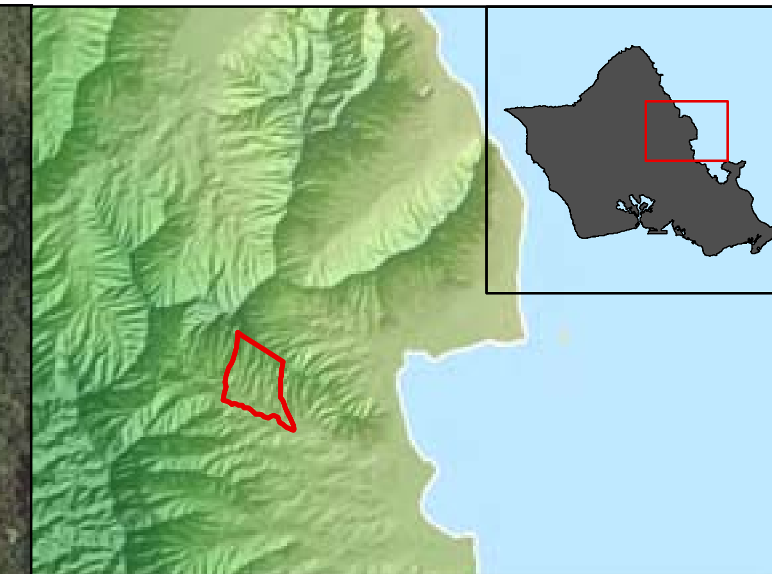


Figure 2
Decision Units &
Estimated MEC/MD
Surface Density Map

Waikane Valley Impact Area
Remedial Investigation / Feasibility Study





Legend

- Decision Units
- Waikane Stream Sampling Areas
- Estimated MEC/MD Surface Density
- Waikane Stream
- Subsurface Sample Location
- SI Sample Point - Exceeded criteria for copper and/or lead

N

530 265 0 530 Feet

1:3,761

Figure 3
Decision Units &
Estimated Subsurface
Anomaly Density Map

Waikane Valley Impact Area
Remedial Investigation / Feasibility Study

Attachment B
Sampling SOPs

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STANDARD OPERATING PROCEDURE
FOR

ANOMALY AVOIDANCE

SOP S-1

AREAS OF CONCERN (AOC)

WAIKANE VALLEY IMPACT AREA
KANEOHE, HAWAII

USA ENVIRONMENTAL, INC.

February 2010

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APPROVALS

This standard operating procedure (SOP) contains the procedures and other information that will be needed by USA Environmental, Inc. (USAE) field staff to conduct anomaly avoidance activities on sites containing material potentially presenting an explosive hazard (MPPEH) during the activities at AOCs at the Waikane Valley Impact Area. By their signatures, the undersigned certify that this SOP is approved for implementation at WVIA and will be used to direct anomaly avoidance operations.

Robert Nore Project Manager	Date
Thomas Bernitt Program Quality Control Manager	Date
TBD Senior UXO Supervisor	Date

SUPERVISOR'S STATEMENT

I have read and understand this SOP. To the best of my knowledge, the activities described in this SOP can be done in a safe, healthful, and environmentally sound manner. I have made sure that all persons assigned to this process are qualified, have read and understand the requirements of this SOP, and have signed the worker's statement for this purpose. I will ensure the SOP contains current procedures. If a major change to the SOP is necessary, I will ensure that the process is stopped until the SOP is revised and approved. If unexpected safety, health, or environmental hazards are found, I will make sure the process is stopped until the hazards have been eliminated.

______________________________________ ____________________

TBD Date

Senior UXO Supervisor

WORKER'S STATEMENT

I have read this SOP and I have received adequate training to perform the procedures addressed in the SOP. If I identify a hazard not addressed in the SOP, or encounter an operation I cannot perform in accordance with the SOP, I will stop the process and notify my immediate supervisor.

Worker's Name	**Date**	**Supervisor's Name**	**Date**

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4. SOIL SAMPLING SITES 7
5. AVOIDANCE PROCEDURES FOR BOREHOLE SAMPLING 7
6. LIVE AND SUSPECT MEC 7
7. SUMMARY 8

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1. PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide USA Environmental, Inc. (USAE) employees and subcontractors with the minimum procedures and safety and health requirements applicable to perform anomaly avoidance operations on sites potentially containing munitions and explosives of concern (MEC) or material potentially presenting an explosive hazard (MPPEH).

2. SCOPE

This SOP applies to all USAE site personnel, including contractor and subcontractor personnel, involved in the conduct avoidance operations on a site containing MEC/MPPEH hazards. The following USAE 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 plans, other USAE SOPs, the USAE Site Health and Safety Plan (SHSP), applicable Federal, State, and local regulations, and contract restrictions and guidance.

3. ANOMALY AVOIDANCE FOR SAMPLING OPERATIONS

Each sampling team will be accompanied by a UXO Technician III or UXO Technician II. The sampling team will not destroy any MEC encountered. All MEC contacts and anomalies will be reported to the Senior UXO Supervisor.

4. SOIL SAMPLING SITES

The UXO technician will conduct a reconnaissance of the approach route to the site and locate a clear path for the sampling team. The UXO technician will clear a work site for soil samples with a magnetometer and clearly mark the boundaries. The area will be large enough to provide a work area for the sampling team. If a pre-selected area indicates magnetic anomalies, a new sampling site will be chosen.

5. AVOIDANCE PROCEDURES FOR BOREHOLE SAMPLING

If surface samples are required they will be obtained prior to the start of boring. The borehole procedures will be completed using a hand auger. The MEC Team will check the borehole with a down-hole magnetometer, a minimum of every 2 feet, to the deepest sampling depth, to ensure that smaller items of MEC, undetectable from the surface, will be detected. The hand auger will be advanced to the first sampling depth and the auger will be withdrawn. A clean auger bucket will be attached to the handle, returned to the borehole and a sample will be collected. At this point the MEC Team will check the borehole with a magnetometer and if no magnetic anomalies are found, the procedure repeated to obtain the required samples.

6. LIVE AND SUSPECT MEC

MEC items encountered will be inspected by the UXO technician, marked, and reported to the SUXOS. Items will be addressed in accordance with the MEC SAP and the APP.

7. SUMMARY

USAE uses proven procedures and methods to provide anomaly avoidance services. Only qualified UXO personnel will perform tasks associated with MEC location, identification, and item condition determination. The procedures outlined in this SOP are based on industry standards and ensure that operations are safely and efficiently performed.

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SOIL SAMPLING

This operating procedure (OP) sets forth the procedures to be used by field personnel who perform soil sampling, surface or subsurface. This OP applies to all field personnel involved with managing or participating in soil sampling activities. However, it is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure when planning or executing planned activities must be approved by the Project Manager.

Responsibilities. The Project Manager is responsible for ensuring that these standard soil sampling procedures are utilized during all projects and that they are conducted or supervised by a qualified individual. The Field Manager is responsible for ensuring that all project field staff follow these procedures.

1 - SUBSURFACE SOIL SAMPLING

The purpose of subsurface soil sampling is to acquire accurate, representative information about subsurface materials penetrated during drilling or trenching. This is accomplished by logging lithologic information, classifying lithologic materials, and collecting lithologic samples for analysis by geotechnical or chemical methods. The specific method for collecting subsurface soil samples will be specified in the project work plan.

1.1 INSPECTION OF EQUIPMENT

The collection of reliable samples of subsurface materials depends partly on the type of samples that can be collected when using various subsurface exploration techniques. These procedures are described in Section 1.5. In all cases, the equipment will be inspected prior to commencement of drilling for signs of fluid leakage, which could introduce contaminants into the soil. If, at any time during subsurface exploration, fluid is observed leaking from the rig, operations will cease and the leak will be immediately repaired or contained. All soil and other materials affected by the leak will be collected, containerized, and labeled for proper disposal as described in OP-F1C, *IDW Management*.

1.2 PREPARATION OF SITE

Proper preparation of the site prior to the commencement of subsurface exploration is essential for smooth drilling operations. It is required to protect the health and safety of site personnel. First, the site will be inspected to ensure that there are no overhead hazards that could affect subsurface exploration. Then, all subsurface sampling locations will be assessed using geophysical methods. If possible, the area will be excavated by hand to a depth of 2 to 3 feet before beginning drilling. If surface or shallow samples are required, it is suggested that the hand excavation be done as close to the actual subsurface exploration as possible. The location of the kill switch for the equipment will be known to all members of the field crew and will be readily accessible.

The equipment will be situated upwind or side-wind of the borehole. The area surrounding, and in the vicinity of, the borehole will be covered with plastic, including the area where cuttings are placed into 55-gallon drums and the equipment decontamination area. The required exclusion zones will be established by using plastic tape or cones to designee the various areas.

1.3 EQUIPMENT DECONTAMINATION

To avoid cross-contamination, all sampling equipment utilized for borehole drilling and soil sampling that may potentially come into contact with environmental samples shall be thoroughly decontaminated as described in OP-F6, *Equipment Decontamination*. All sampling tools will be decontaminated between each sampling event and between each borehole or trench. At a minimum, all equipment will be steam-cleaned or undergo the wash and rinse process. All wash and rinse water will be collected, containerized, and labeled for proper disposal as described in OP-F1C, *IDW Management*. Clean equipment (e.g., augers and samplers) will be protected from contact with contaminated soils or other contaminated materials prior to sample collection. Equipment will be kept on plastic or protected in another suitable fashion. After a borehole is completed, all augers and contaminated downhole equipment will be stored on plastic sheeting.

1.4 HANDLING OF IDW

Investigation-derived waste (IDW) will consist of soil cuttings and decontamination rinsate. All IDW soil cuttings from borehole drilling will be placed into 55-gallon drums or other appropriate containers. The containerized cuttings will be stored in a centralized area pending sample analysis to determine their final disposition. Detailed drum handling and labeling procedures are described in OP-F1C, *IDW Management.*

1.5 SUBSURFACE SOIL SAMPLE COLLECTION METHODS

Table 1 describes the characteristics of the sampling methods available for the drilling techniques frequently employed for conducting soil borings and monitoring well installation as described in OP-F4A, *Monitoring Well Installation*. The split-spoon sampling method is the most commonly used soil sampling technique. However, in certain circumstances, other methods may have to be used to obtain optimal soil sampling results. The project work plan will specify the sample collection method that will be used on the project.

TABLE 1

Characteristics of Common Subsurface Formation-Sampling Methods

TYPE OF FORMATION	SAMLPE COLLECTION METHOD	SAMPLE QUALITY	Potential for Continuous Sample Collection	Samples Suitable for Analytical Testing	Discrete Zones Identified?
Unconsolidated	Bulk Sampling (Cuttings)	Poor	No	No	No
	Thin Wall	Good	Yes	Yes	Yes
	Split-spoon	Good	Yes	Yes	Yes
	Trench	Good	No	Yes	Yes
	Core Barrels	Good	Yes	Yes	Yes
Consolidated	Cuttings (Direct Rotary)	Poor	No	No	No
	Core Barrels	Good	Yes	Yes	Yes

The following text describes the primary soil sampling methods used by field personnel.

SPLIT-SPOON SAMPLES

Split-spoon sampling is usually used in conjunction with the hollow-stem or solid-stem auger drilling method and can be used for sampling most unconsolidated and semi-consolidated sediments. It is less frequently used for air and mud rotary, and casing drive methods. It cannot normally be used to sample bedrock such as basalt, limestone, or granite. The method can be used for highly unconsolidated sands and gravels if a stainless-steel sand catcher is placed in the lower end of the sampler.

The split-spoon sampler consists of a hardened metal barrel 2 to 3 inches in diameter (2 to 2.5 inches inner diameter) with a threaded, removable fitting on the top end for connection to the drill rods and a threaded, removable "shoe" on the lower end that is used to penetrate the formation. The barrel can be split along its length to allow removal of the sample.

The steps required to obtain a representative soil sample using a split-spoon sampler are presented below.

- The borehole is advanced by augering until the top of the desired sampling interval is reached. The drill bit is then withdrawn from the hollow-stem augers.
- If samples are to be retained for laboratory analytical analysis, the sampler will be equipped with interior liners that are composed of materials compatible with the suspected contaminants. Generally, these liners consist of brass or stainless steel and are slightly smaller than the inner diameter of the sampler. If samples are to be analyzed for metals, it is recommended that stainless steel liners be used rather than brass. The composition of the liners will always be evaluated with respect to the types of contaminants that are suspected.

- The properly decontaminated split-spoon sampler (equipped with liners) is attached either to the drill rods or to a cable system and lowered to the bottom of the borehole through the augers.
- The sampler is then driven into the formation by either a manual or automatic hammer (usually a 140-pound weight dropped through a 30-inch interval). The number of blows required to drive the sampler should be recorded at 6-inch intervals in the boring log because blow counts provide an indication of the density/compaction of the soils being sampled. The field geologist, hydrogeologist, or geotechnical engineer will carefully observe the internal measuring technique of the driller and keep track of sampling materials to ensure that accurate location of samples is achieved. Continuous samples can be collected with the split-spoon method by augering or drilling to the bottom of the previously sampled interval and repeating the operation. Whether continuous or intermittent, the sample collected with this method is disturbed and cannot be used for certain geotechnical tests that require undisturbed samples.
- Following sample acquisition, the split-spoon sampler is brought to ground surface and removed from the drill rods or cable system. The upper and lower fittings are loosened and the sampler is taken to the sample handling area. At the sample handling area, the fittings are removed, the barrel of the sampler is split, and one side of the sampler is removed. At this time, it is important to observe and record the percentage of sample recovery.
- The liners containing the soil samples are immediately removed from the sampler. Generally, the lowermost liner is considered the least disturbed and will be retained as the analytical laboratory sample. However, in certain circumstances (such as with the use of a sand catcher), other liners may be more appropriate for retention as the laboratory sample. The ends of the sample liner to be retained as the analytical laboratory sample will be covered with Teflon® film and capped with clean plastic end caps. The site geologist, hydrogeologist, or geotechnical engineer will observe the ends of the liner destined for analytical sampling and describe the physical nature of the sample (e.g., soil or rock type, grain size, color, moisture, etc. The sample will then be labeled according to OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*, and immediately placed on ice in a cooler as described in OP-QC3, *Sample Handling, Storage, and Shipping Procedures.*
- The remaining liners collected from the sample, if any, can then be used for other purposes. These include providing a duplicate sample for field QC or material for lithologic logging. These samples can also be used for headspace analysis as described in Section 3.
- Lithologic logging of each sample shall be conducted and entered into the boring log presented in Figure 1. In most instances, an additional liner full of material is available for this purpose. A check will be made to ensure that the liners all contain similar material. If an extra liner full of material is not available, then logging will be accomplished by collecting the extra material present in the end of the sampler shoe. A comparison to the material visible at the end of the sample liner destined for laboratory analysis will be made to ensure that the entire sample consists of similar material. If not, then the different material is described to the extent possible by relating it to similar material previously encountered.

- If volatile organic compounds are suspected to be present, screening of the sample with an OVM or equivalent, and collection of headspace samples will also be conducted according to the methods outlined in Section 3.
- All sampling equipment must be decontaminated prior to each use according to the methods presented in OP-F6, *Equipment Decontamination*.

THIN-WALL SAMPLES

The thin-wall or Shelby tube sampler is usually used in conjunction with the hollow-stem and solid-stem auger drilling methods and is most useful when sampling clay- and silt-rich sediments. It can also be used with air and mud rotary, and casing drive drilling techniques. It is amenable only to lithologies that are relatively soft and, in some cases, is not capable of penetrating even hard clays or compacted sands. In addition, samples of unconsolidated sands cannot normally be acquired because they cannot be retained within the sampler, although a sand catcher can be utilized in some cases with moderate success.

The thin-wall sampler often consists of a single thin tube that is 3 to 4 inches in outer diameter and 1 to 3 feet in length. The upper end of the sampler has a solid metal section with a fitting for attachment to the drill rods. There is no fitting for the lower end of the sampler and it is usually open to allow sample acquisition; however, when sampling in poorly consolidated materials, a sand catcher may be placed in the lower end to ensure retention of the sample.

The steps required to obtain a representative soil sample using a thin-wall sampler are presented below.

- The borehole is advanced by augering or drilling until the top of the desired sampling interval is reached. The drill bit is then withdrawn.
- The sampler is placed on the end of the drill rods and lowered to the bottom of the borehole.
- Instead of driving the sampler, the hydraulic apparatus associated with the kelly bar on the drilling rig is used to press the sampler into the undisturbed formation. The thin-wall sampler may not have sufficient structural strength to penetrate the materials, in which case another sampling technique may be required. The samples obtained using this method cannot be used for certain geotechnical tests where undisturbed samples are required.
- Following sample acquisition, the thin-wall sampler is brought to the ground surface, removed from the drill rods, and taken to the sample handling area.
- If the sample is to be retained as a laboratory sample, the ends of the sample should be immediately covered with Teflon® film and sealed with clean plastic end caps. The sample will then be labeled according to OP-QC2, *Record Keeping Sample Labeling, and Chain of Custody Procedures* and immediately placed on ice in a cooler. If the sample is to be used only for lithologic logging, it may be extruded from the sampler and inspected.
- Lithologic logging of each sample shall be conducted and entered into the boring log presented in Figure 1. If the sample is contained in a sleeve, the ends of the sample in the sleeve will be observed to assess lithologic and stratigraphic characteristics.

- If volatile organic constituents are suspected to be present, screening of the sample with an OVM or equivalent, and collection of headspace samples will also be conducted according to the methods outlined in Section 3.
- All sampling equipment must be decontaminated prior to each use according to the methods presented in OP-F6, *Equipment Decontamination.*

CORES

A core barrel is often utilized to obtain core samples from harder lithologic materials such as basalt, granite, and limestone, in instances where undisturbed samples are required for geotechnical testing, and in cases where completely continuous sampling is required. Complete recovery of samples during coring is often difficult when sampling unconsolidated and semi-consolidated lithologies such as clays, silts, and sands.

Rock coring methods have been standardized by the American Society for Testing and Materials (ASTM D-2113). Several standardized core sizes for bits, shells, and casings have been established (e.g., RX, NX, SW). The various size standards for core barrels and bits are summarized in Table 2.

TABLE 2

Standard Core Barrel Sizes (in inches)

DESCRIPTION	RX or RW	EX or EW	AX or AW	BX or BW	NX or NW	HX or HW	PX or PW	SX or SW	UX or UW	ZX or ZW
Bit Set Normal I.D.	0.750	0.845	1.185	1.655	2.155	3.000	--	--	--	--
Bit Set Normal and Thin-wall O.D.	1.160	1.470	1.875	2.345	2.965	3.890	--	--	--	--
Bit Set Thin-Wall I.D.	0.735	0.905	1.281	1.750	2.313	3.187	--	--	--	--
Shell Set Normal and Thin-wall O.D.	1.175	1.485	1.890	2.360	2.980	3.907	--	--	--	--
Casing Bit Set I.D.	1.000	1.405	1.780	2.215	2.840	3.777	4.632	5.632	6.755	7.755
Casing Bit Set and Shoe O.D.	1.485	1.875	2.345	2.965	3.615	4.625	5.650	6.780	7.800	8.810

The selection of the most practical core barrel for the anticipated bedrock conditions is important. The selection of the correct drill bit is also essential to good recovery and drilling production. Although the final responsibility of bit selection usually rests with the drilling contractor, there is a tendency in the trade to use "whatever happens to be at hand." The selection of the diamond size, bit crown contour, and number of water ports is dependent upon the characteristics of the rock mass. The use of an incorrect bit can be detrimental to the overall core recovery. Generally, fewer and larger diamonds are used to core soft formations and more numerous, smaller diamonds, which are mounted on the more commonly used, semi-round bit crowns, are used in hard formations. Special impregnated diamond core bits have been developed recently for use in severely weathered and fractured formations where bit abrasion can be very high.

Core barrels are manufactured in three basic types: single tube, double tube, and triple tube. These basic units all operate on the same principle of pumping drilling fluid through the drill rods and core barrel. This is done to cool the diamond bit during drilling and to carry the borehole cuttings to the surface. A variety of coring bits, core retainers, and liners are used in various combinations to maximize the recovery and penetration rate of the selected core barrel.

The rotary core barrels that are available range from 1 to 10 inches in diameter, and the majority may be used with water, drilling mud, or air for recovering soil samples. Of the three basic types of core barrels, the double tube core barrel is most frequently used in rock core sampling for geotechnical engineering applications. The triple tube core barrel is used in zones of highly variable hardness and consistency. The single tube, because of its sample recovery and disturbance problems, is rarely used.

Single Tube. The simplest type of rotary core barrel is the single tube, which consists of a case hardened, hollow steel tube with a diamond drilling bit attached at the bottom. The diamond bit cuts an annular groove or kerf in the formation to allow passage of the drilling fluid and cuttings up the outside of the core barrel. However, the drilling fluid must pass over the recovered sample during drilling and the single tube core barrel cannot be employed in formations that are subject to erosion, slaking, or excessive swelling.

Double Tube. The most popular and widely used rotary core barrel is the double tube, which is basically a single tube barrel with a separate and additional inner liner and is available in either a rigid or swivel type of inner liner construction. In the rigid types, the inner liner is fixed to the outer core barrel so that it rotates with the outer tube. In contrast, the swivel type of inner liner is supported on a ball bearing carrier which allows the inner tube to remain stationary, or nearly so, during rotation of the outer barrel. The sample or core is cut by rotation of the diamond bit. The bit is in constant contact with the drilling fluid as it flushes out the borehole cuttings. The addition of bottom discharge bits and fluid control valves to the core barrel system minimizes the amount of drilling fluid and its contact with the sample, which further decreases sample disturbance.

Triple Tube. The third and most recent advancement in rotary core barrel design is the triple-tube core barrel, which adds another separate, non-rotating liner to the double tube core barrel. This liner, which retains the sample, consists of a clear plastic solid tube or a split, thin metal liner. Each type of liner has its distinct advantages and disadvantages; however, they are both capable of obtaining increased sample recovery in poor quality rock or semi-cemented soils, with the additional advantage of minimizing sample handling and disturbance during removal from the core barrel.

Coring to obtain analytical samples will utilize only filtered air as the drilling fluid. The core barrel operates by rotating the outer barrel to allow the bit to penetrate the formation. The sample is retained in the inner liner, which in most samplers does not rotate with the outer barrel. As the outer barrel is advanced, the sample rises in the inner liner. In general, a secondary liner consisting of plastic or metal is present within the inner liner to ensure the integrity of acquired samples.

Soil or rock core samples will be obtained with a core barrel or a 5-foot split-spoon core barrel using the following procedure:

- The core barrel will be drilled to the appropriate sampling depth. *Note:* the only drilling fluid to be used while coring to obtain samples for laboratory analysis is clean filtered air (i.e., particulate- and petroleum-free). Distilled water may be added through the delivery system of the coring device by the driller, if necessary, provided that the drilling returns cannot be brought to the surface by air alone.
- The core barrel is then retrieved from the hole. Care must be taken to ensure that the contents of the core barrel do not fall out of the bottom of the core barrel during withdrawal and handling.
- Open the core barrel by removing both the top and bottom fittings. The sample within the inner liner can then be removed from the core barrel and taken to the sample handling area.
- Lithologic logging of each sample shall be conducted and entered into the boring log presented in Figure 1.
- If volatile organic compounds are suspected to be present, screening of the sample with an OVM or equivalent, and collection of headspace samples shall also be conducted according to the methods outlined in Section 3.
- If rock core samples are to be recovered for analytical laboratory or geotechnical analyses, the core barrel will either be lined with a sample container (e.g., either stainless steel or acrylic tubes), or the samples will be transferred to the liners immediately after the core barrel is opened. They will be placed in stainless steel tubes and sealed with clean plastic end caps. The tubes will be sealed and labeled according to OP-QC2, *Record Keeping, Sample Labeling, and Chain of Custody Procedures*, and OP-QC3, *Sample Handling, Storage, and Shipping Procedures*, and immediately placed on ice in a cooler.
- If samples are to be cataloged and stored, they will be placed in core boxes. The task order number, site name, borehole number, start depth, end depth, date, and name of the geologist, hydrogeologist, or geotechnical engineer will be affixed to the core box. Storage will occur in a clean, dry area onsite during the duration of field sampling; samples will not be brought back to the office or equipment storage area. At the completion of field sampling, proper disposal will be documented.
- All sampling equipment must be decontaminated prior to each use according to the methods presented in OP-F6, *Equipment Decontamination*.

BULK SAMPLES

The term "bulk sample" is used to represent a sample collected from borehole cuttings either from the hollow-stem auger flights or the discharge of any of the rotary or cable tool drilling techniques. This type of sample is useful for describing soils or consolidated materials, where no undisturbed samples representative of a specific depth are being collected. It should be noted that this type of sample is generally considered to be the least acceptable of the types of samples previously described in this section and will be used only when detailed lithologic data are not needed.

Handling and lithologic logging of bulk samples should be performed in a manner consistent with that used for split-spoon samples. An estimate of the depth (or range of depths) from which the sample was obtained, and date and time of collection should be recorded on the boring log. Samples are usually collected every 5 feet, preferably at several different times during a 5-foot drilling run so that lithologic variations occurring over the drilling interval can be noted. Rock fragments commonly range in size from 1/16 to 1/2 inch, with many fragments larger than 1/4 inch. Larger fragments can often be obtained with reverse circulation rotary drilling. Rotary-tool samples usually contain some caved materials from above and, when drilling with mud or water rotary, the cuttings may contain soil and rock recirculated by the mud/water pump; therefore, care must be exercised when interpreting lithologic logs completed using data from this type of sample.

Because the collection of samples at the surface lags behind the actual drilling of a given lithologic bed at depth, the samples usually represent a depth less than that of the current depth of the drill bit. The amount of lag may be significant in deeper boreholes, but can be eliminated by collecting samples after circulating for a period of time sufficient to permit the most recently drilled materials to reach the surface.

BOREHOLE ABANDONMENT

Following completion of soil sampling, the borehole will be properly abandoned unless a monitoring well is to be installed. Abandonment will occur immediately following acquisition of the final sample in the boring and will consist of the placement of a bentonite-cement grout from the bottom of the boring to within 2 feet of ground surface. The grout mixture will consist of a mix of 7 to 9 gallons of water per 94-pound bag of Portland Type I or II cement with 3 to 5 percent by weight of powdered bentonite. The bentonite-cement grout will be placed in one continuous pour from the bottom of the boring to within at least 0.5 to 2 feet of ground surface through a tremie pipe or hollow-stem augers. Additional grout may need to be placed if significant settlement occurs. The remaining portion of the boring can be filled with topsoil.

TRENCHING AND PIT SAMPLING

Trenching is used in situations where the depth of investigation generally does not exceed 10 to 15 feet and is most suitable for assessing surface and near-surface contamination and geologic characteristics. In addition, trenching allows detailed observation of shallow subsurface features and exposes a wider area of the subsurface than is exposed in borings. Pit sampling is typically conducted in conjunction with a removal or remedial action.

A backhoe is usually used to excavate shallow trenches to a depth of no greater than 15 feet. Front-end loaders or bulldozers are used when it is not possible to use a backhoe, for example, when materials lack cohesion or are too stiff, or the terrain is too steep for a backhoe. Larger excavations (i.e., pits) may require additional equipment as described in the Work Plan or equivalent document.

Typically, trenches have widths of one to two backhoe buckets and range in length from 5 to 20 feet, although larger trenches can be dug depending on the objectives of the study. Pits will vary in size depending upon the scope of the removal/remedial action. Soils removed from the trench/pit will be carefully placed on plastic sheeting or other appropriate materials in the order of removal from the trench or excavation. The shallow excavated materials can be placed on one side of the trench/excavation and deeper materials on the other side to allow better segregation of shallow and deep materials.

Soil sampling locations within each trench or pit will be chosen on the basis of visual inspection and any VOC screening results. Samples will be collected from either the sidewalls or the bottom of the trenches/excavations. Soil sampling should be conducted outside the trench/excavation and personnel generally should not enter a trench or pit if there is any other means (e.g., backhoe buckets, hand augers, shovels, or equivalent) to perform the work. If entry is unavoidable, then a competent person will first determine acceptable entry conditions including sloping, shoring, and air monitoring requirements, personal protective equipment, and inspections. In addition, the site-specific Safety and Health Plan must be amended to include applicable requirements of 29 CFR 1910.146 and 29 CFR 1926 Subpart B.

Equipment employed for trench/pit sampling may include hand augers, core samplers (slide hammer), liners inserted manually into the soil, or hand trowels. In addition, samples may be obtained directly from the trench or from the backhoe bucket. All samples will be properly sealed and labeled according to procedure OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*, and immediately placed on ice in a cooler as indicated in procedure OP-QC3, *Sample Handling, Storage, and Shipping Procedures*. Sample locations and descriptions will be described and recorded on the field trench/pit log.

Following completion of the excavation activities, the exposed materials will be observed for lithologic and contaminant characteristics. Detailed mapping of the exposed walls of the trench will be conducted, although in no instance will personnel enter a trench without first determining acceptable entry conditions including sloping, shoring, and air monitoring requirements, personal protective equipment, and inspections as defined in 29 CFR 1910.146 and 29 CFR 1926 Subpart B. A useful mapping technique for extremely long trenches or large pits is to examine the vertical profile of the excavation at horizontal intervals of 5 to 10 feet, in a manner similar to the method typically used for preparation of a geologic cross-section using soil borings. Field observations will be noted in the field logbook and described in detail on a trench/pit log.. The lithologic description will include all soil classification information. A cross section of the trench or pit should also be included on the field trench/pit log. Photographs of the trench/pit are also an excellent way to document important subsurface features.

During backfilling of the excavation, the materials excavated from the greatest depth should be placed back into the excavation first. Lithologic materials should be replaced in 2- to 4-foot lifts and recompacted by tamping with the backhoe bucket. For certain land uses or site restoration may require more appropriate compaction methods. These methods will be described in the Work Plan, and design documents. The backfilled trench/pit will be capped with the original surface soil. If materials are encountered that cannot be placed back in the excavation, they should be placed either in 55-gallon open-top drums or placed on and covered with polyethylene plastic sheeting or equivalent material and treated as IDW in accordance with OP-F1C, *IDW Management.*

2 - SURFACE SAMPLING

The method of collecting surface samples will be specified in the project work plan. All surface soil samples will be accurately located on field maps. Detailed descriptions will be recorded in the field logbook or on a surface soil sampling log. Methods commonly utilized for collection of surface soil samples are described below.

2.1 HAND TROWEL

A stainless steel or disposable hand trowel may be utilized for sampling surface soil. The hand trowel is initially used to remove the uppermost 2 inches of soil and is then used to acquire a representative sample of deeper materials to a depth of 6 inches. Generally, only samples within the upper 6 inches of soil should be sampled using these methods. The depth of the sample will be recorded in the field logbook or on a surface soil sampling log.

Soil samples collected using a hand trowel are usually placed into pre-cleaned, wide-mouth glass jars. The jar is then sealed with a tight-fitting cap, labeled according to OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*, and placed on ice in a cooler in accordance with OP-QC3, *Sample Handling, Storage, and Shipping Procedures*. All sampling equipment must be decontaminated prior to each use according to the methods presented in OP-F6, *Equipment Decontamination*.

2.2 HAND AUGER

A soil recovery hand auger (SRA) consisting of a metal rod, handle, detachable stainless steel core barrel, and inner sleeves can be used to obtain both surface soil and trench samples. Multiple extensions can be connected to the sampler to facilitate the acquisition of samples at depths up to 15 feet below the existing ground surface.

Pre-cleaned sample liners are loaded into the core barrel prior to sampling. In general, these liners are used not only to acquire samples, but also serve as a sample container for non-volatiles. If not enough sample can be collected to completely fill a liner, samples can be transferred to wide-mouth glass jars. In either case, the sample will be labeled according to OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* and immediately placed on ice in a cooler as indicated in OP-QC3, *Sample Handling, Storage, and Shipping Procedures*. To minimize possible cross-contamination, the SRA and sample liners will be decontaminated prior to each use according to the procedures described in OP-F6, *Equipment Decontamination*.

2.3 SLIDE HAMMER SAMPLING

In instances where the soil type precludes the acquisition of soil samples using the SRA, a manually operated slide hammer can be used to collect relatively undisturbed soil samples from excavations and surface soils. The slide hammer consists of a 6- to 12-inch core barrel that is connected to the slide hammer portion of the device using detachable extensions.

The core sampler is typically loaded with two to four sample liners, depending on the liner length, which are not only used to acquire the samples, but also serve as a sample container for non-volatiles. Immediately following acquisition, samples will be labeled according to OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* and immediately placed on ice in a cooler as indicated in OP-QC3, *Sample Handling, Storage, and Shipping Procedures*.

All of the sampling equipment that comes into contact with the sample medium shall be decontaminated in accordance with the OP-F6, *Equipment Decontamination*. Split-barrel slide hammer core samplers, which have recently become available, are much easier to decontaminate than the older, single-piece core barrel, and should be utilized in place of the older core barrels, where possible.

2.4 HAND SAMPLING USING SAMPLE LINERS

Surface soil samples can sometimes be collected by hand using just the sample liners. This method can be used in cases where the surface soils are soft or where it is advantageous to minimize the disturbance of the sample (such as when sampling for volatiles). Obtaining surface soil samples with this method consists merely of pushing or driving the sample tube into the ground by hand.

The sample liner (with the collected sample inside) is then removed from the ground and capped with Teflon® film and capped with clean plastic end caps. The sample is labeled according to OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures* and immediately placed on ice in a cooler as indicated in OP-QC3, *Sample Handling, Storage, and Shipping Procedures.* All liners will be decontaminated prior to use, in accordance with OP-F6, *Equipment Decontamination*. Since the only equipment used are the sample liners themselves, this method helps to minimize the required amount of equipment decontamination.

3 - VOLATILE ORGANICS SCREENING AND HEADSPACE ANALYSIS

Volatile organics screening and headspace analysis is performed to preliminarily assess if the sample contains volatile organic compounds (VOCs). Volatile organics screening and headspace analysis of samples will be performed using a photoionization detector (i.e., Thermo 580EZ).

Volatile organics screening and headspace analysis is intended as a field screen for the presence of VOCs. This method measures the presence or absence of VOCs in the headspace (air) above a soil sample. Various factors affect the level of VOCs volatilizing from soils, such as concentration in the soil, temperature of the soil and air, organic carbon content of the soil, equilibration time, moisture content of the soil, and the chemical and physical characteristics of the VOCs. Therefore, headspace readings can only be regarded as qualitative assessments of volatiles, and caution should be exercised if using this technique to select samples for analytical testing.

In order to screen samples for VOCs, the instrument probe will be inserted into the top of the sample liner immediately after the sampler is opened. The instrument response (normally in ppm) is then recorded in the field logbook and/or the field log. For headspace analysis, a portion of the sample is transferred into a sealable plastic bag or pre-cleaned glass jar, which is then sealed and agitated. The VOCs are allowed to volatilize into the headspace and equilibrate for 15 to 30 minutes. Next, the instrument probe is then inserted into the container to sample the headspace, and the instrument response is recorded in the field logbook and/or the field log.

4 - RECORDS

Soil classification information collected during soil sampling should be documented in the field logbook or on borehole, trench, and surface soil log forms. All log entries will be made in indelible ink. Information concerning sampling activities will be recorded in the field logbook or on sample log forms. Copies of this information should be kept in the project files.

5 - HEALTH AND SAFETY

Standard health and safety practices will be observed according to the site-specific Safety and Health Plan (SSHP). Ambient air and soil vapor monitoring may be performed to provide data related to relative volatile contaminant concentrations and determine the appropriate personal protective equipment (PPE). An air monitoring program (if required) and suggested PPE will be outlined in the SSHP.

Suggested minimum PPE during soil sampling activities will include disposable nitrile gloves, steel-toed boots, safety glasses, hearing protection around heavy equipment in operation, and an ANSI-Standard hard hat. Half-face respirators and cartridges may be necessary depending on the contaminant concentrations. At no time during soil sampling activities are personnel to reach for debris near machinery that is in operation.

In addition to the aforementioned precautions and depending upon the type of contaminant expected, the following safe work practices will be employed:

<u>Particulate or Metal Compounds:</u>

- Avoid skin contact and/or incidental ingestion of soil.
- Utilize protective clothing, steel-toed boots, gloves, safety glasses, and hearing protection as warranted.

<u>Volatile Organic Compounds:</u>

- Avoid breathing constituents venting from soil borings, trenches, pits, or holes by approaching upwind, and/or by use of respiratory protection.
- For trenches, pits, or holes, pre-survey the area with a FID/PID prior to sampling.
- If monitoring results indicate organic vapors that exceed action levels as specified in the SSHP, sampling activities may need to be conducted in Level C protection. At a minimum, skin protection will be required by use of gloves and Tyvek® or other media that is protective against the media being encountered.

Flammable or Explosive Conditions:

- Explosive gases should be monitored as continuously as possible using an explosimeter and oxygen meter.
- All ignition sources should be placed upwind or crosswind of the borehole.
- If explosive gases exceed the designated action levels as specified in the SSHP, cease operations and evaluate conditions.

Physical Hazards Associated With Soil Sampling:

- To avoid possible back strain associated with sample collection, use the large muscles of the legs, not the back when retrieving soil samplers.
- Stay clear of all moving equipment and avoid wearing loose fitting clothing.
- To avoid slip/trip/fall hazards, be wary of open trenches, pits, or holes.
- To avoid heat/cold stress as a result of exposure to extreme temperature and PPE, drink electrolyte replacement fluids (1-2 cups/hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
- Be aware of restricted mobility due to the wearing of PPE.
- To avoid hand, wrist, arm, shoulder, and back trauma due to the use of slide hammers or hand augers, rotate sampling among field personnel.

6 - REFERENCES

OP-F1C, *IDW Management.*

OP-F4A, *Monitoring Well Installation.*

OP-F6, *Equipment Decontamination.*

OP-QC2, *Record Keeping, Sample Labeling, and Chain of Custody Procedures*.

OP-QC3, *Sample Handling, Storage, and Shipping Procedures.*

U.S. Navy, 1996. Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP). September 1996.

INCREMENTAL SOIL SAMPLING

This operating procedure (OP) sets forth the procedures to be used by field personnel who collect incremental soils samples, surface or subsurface. This OP is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure when planning or executing planned activities must be approved by the Project Manager.

Responsibilities. The Project Manager is responsible for ensuring that these standard soil sampling procedures are utilized during applicable projects and that they are conducted or supervised by a qualified individual. The Field Manager is responsible for ensuring that all project field staff follow these procedures.

1 - SCOPE AND APPLICATION

This method involves the use of a plastic scoop for soil sample collection. This procedure may also be used when collecting soil samples using other sampling equipment such as trowels, syringes, hand augers. This method is designed to provide representative soil samples for subsequent analyses. Each project QAPP will state the required number, volume, and depth of incremental soil samples.

2 - METHOD SUMMARY

- Using a non-metallic scoop, soil is collected at each increment location and placed in an aluminum foil-lined mixing bowl. The aliquot from each increment location will be as equal in volume as possible.
- All rocks and organic debris are to be removed from the samples.
- The increments are then thoroughly mixed using gloved hands and the sample scoop. Any clumps of soil are to be broken up. Remove any remaining rocks and debris.
- The sample is then transferred to the sample container.
- The sample container is assigned a unique serialized identification number.
- Sample containers are stored and transported in a cooler and, if necessary, held at 4 + 2^{o}C.

3 - APPARATUS & MATERIALS

- Plastic scoop or trowel
- Tape measure
- Survey stakes or flags
- Stainless steal, plastic, or other appropriate homogenization-mixing bowl, 2-liter capacity
- Roll of aluminum foil to line mixing bowl
- Precleaned, glass wide-mouth sample containers (8 ounce, 16 ounce, or 1-liter capacity) with PTFE lined caps
- Sample labels and clear tape
- Sample cooler(s) and ice
- Plastic sheeting

- Storage/disposal bags
- Personnel Protection Equipment (PPE) i.e.: protective gloves, eye protection, and disposable latex/nitrile gloves

4 - SAMPLING PROCEDURE

4.1 Soil Sample Increment Location

- Stake the sampling point location
- Spread plastic sheeting on the ground near the sampling point location to keep sampling equipment decontaminated and prevent cross-contamination.
- Don PPE, and prepare sampling equipment and containers. (Use the same plastic scoop or trowel for sampling each decision unit).
- Select a location for collecting a soil increment no more than ½ foot from the stake.
- Sketch or photograph the sample area and note any recognizable features for future reference.

4.2 Sample collection

- Clear the sample area of any debris (leaves, rocks, twigs).
- Using a plastic scoop, remove the thin layer of soil that contacted the debris that was removed.
- Using the scoop, dig a trench up to 6 inches deep around a sample block.
- Remove the sample block by cutting it loose from the ground using the plastic scoop
- Place the soil into an aluminum foil lined mixing bowl.
- Remove all roots and other debris, rocks and pebbles from the bowl.
- Measure from the stake and collect another incremental sample. Place the soil increment in the foil lined mixing bowl.
- Continue to the other designated sampling points and repeat the collection procedure.
- Collect multiple increments into the same mixing bowl.

4.3 Sample Homogenization

- The sample in the mixing bowl should be mixed with a plastic scoop and/or gloved hands.
- This soil should be disaggregated to less than a 6mm diameter as the sample is mixed using gloved hands and sample scoop.
- Gather the soil into a pile in the middle of the container and divide into quarters.
- Mix each quarter, and then combine soils from opposite corners and mix together. Partition the soil into quarters again.
- Mix each quarter, and this time combine and mix quarters from adjacent sides.
- Combine and mix the whole sample.
- Repeat the mixing procedures until the sample achieves a consistent physical appearance.
- Increment sample should be collected into a single labeled sample container to represent the soil for each transect line segment.
- Use a new set of clean gloves, scoop, and foil liner for each area sampled.

5 - HANDLING AND PRESERVATION

Each project QAPP will specify the sample handling and preservation requirements. Most soil samples must be stored in a cooler at 4 +2^{o}C immediately after collection. Check that a PTFE liner is present in the container cap, and secure the cap tightly.

6 - QUALITY CONTROL

6.1 Equipment

- A new pair of gloves, plastic scoop, and mixing bowl aluminum foil liner must be used per sampling area to prevent cross-contamination between segments.
- Single use spatula, scoop, aluminum foil mixing bowl liner must be disposed of in a plastic bag after all loose soil has been removed from the scoop.
- Any equipment that is reused must be cleaned, rinsed with deionized water, isopropanol, and air-dried before reuse.

6.2 Co-located Field Sample

- Each project QAPP will specify the number of co-located field samples to be collected, if any.
- A co-located field sample is acquired by collecting increments up to 0.5 feet from the original increment locations.
- Record the approximate distance in the field logbook.
- Each co-located field sample containers must be uniquely identified.

7 - HEALTH AND SAFETY

Refer to the project Health and Safety Plan for specific requirements. A minimum of two people must be assigned to a sampling team to promote safety and expedite the process of collecting samples, labeling container, and completing field records. The minimum required Personal Protection Equipment (PPE) includes:

- Leather shoes or boots, long pants, and sleeved shirt.
- Disposal gloves to avoid skin contact with contaminated soils and prevent cross-contamination. Disposable latex/nitrile unpowered gloves are recommended.
- Eye protection such as safety glasses or face shields.
- Protective leather gloves to prevent cuts and scratches in heavy wooded areas.

Standard health and safety practices will be observed according to the site-specific Safety and Health Plan (SSHP). Ambient air and soil vapor monitoring may be performed to provide data related to relative volatile contaminant concentrations and determine the appropriate personal protective equipment (PPE). An air monitoring program (if required) and suggested PPE will be outlined in the SSHP.

In addition to the aforementioned precautions and depending upon the type of contaminant expected, the following safe work practices will be employed:

Particulate or Metal Compounds:

- Avoid skin contact and/or incidental ingestion of soil.
- Utilize protective clothing, steel-toed boots, gloves, safety glasses, and hearing protection as warranted.

Volatile Organic Compounds:

- Avoid breathing constituents venting from soil borings, trenches, pits, or holes by approaching upwind, and/or by use of respiratory protection.
- For trenches, pits, or holes, pre-survey the area with a FID/PID prior to sampling.
- If monitoring results indicate organic vapors that exceed action levels as specified in the SSHP, sampling activities may need to be conducted in Level C protection. At a minimum, skin protection will be required by use of gloves and Tyvek® or other media that is protective against the media being encountered.

Flammable or Explosive Conditions:

- Explosive gases should be monitored as continuously as possible using an explosimeter and oxygen meter.
- All ignition sources should be placed upwind or crosswind of the borehole.
- If explosive gases exceed the designated action levels as specified in the SSHP, cease operations and evaluate conditions.

Physical Hazards Associated With Soil Sampling:

- To avoid possible back strain associated with sample collection, use the large muscles of the legs, not the back when retrieving soil samplers.
- Stay clear of all moving equipment and avoid wearing loose fitting clothing.
- To avoid slip/trip/fall hazards, be wary of open trenches, pits, or holes.
- To avoid heat/cold stress as a result of exposure to extreme temperature and PPE, drink electrolyte replacement fluids (1-2 cups/hour is recommended) and, in cases of extreme cold, wear fitted insulating clothing.
- Be aware of restricted mobility due to the wearing of PPE.
- To avoid hand, wrist, arm, shoulder, and back trauma due to the use of slide hammers or hand augers, rotate sampling among field personnel.

8 - REFERENCES

US Navy, 1996. Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP). September 1996.

US Navy, 2003. US Navy Range Sustainability Environmental Program Assessment Policy Implementation Manual, December.

EQUIPMENT DECONTAMINATION

This operating procedure (OP) describes methods of equipment decontamination of field equipment used to sample environmental media. Decontamination of equipment used in soil/sediment sampling, ground-water monitoring, well drilling and well development, as well as equipment used to sample ground water, surface water, sediment, waste, wipe, asbestos, and unsaturated zone is necessary to prevent cross-contamination and to maintain the highest integrity possible in collected samples. Planning a decontamination program requires consideration of the following factors:

- The location where the decontamination procedures will be conducted.
- The types of equipment requiring decontamination.
- The frequency of equipment decontamination.
- The cleaning technique and types of cleaning solutions appropriate to the contaminants of concern.
- The method for containing the residual contaminants and wash water from the decontamination process.
- The use of a quality control measure to determine the effectiveness of the decontamination procedure.

This OP describes standards for decontamination, including the techniques to be used, frequency of decontamination, cleaning solutions, and effectiveness. However, this OP is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in the planning or execution of activities must be approved by the Project Manager.

1 - DECONTAMINATION AREA

An appropriate location for the decontamination area at a site will be selected on the basis of the ability to control access to the area, the ability to control residual material removed from equipment, the need to store clean equipment, and the ability to restrict access to the area being investigated. The decontamination area will be located an adequate distance away and upwind from potential contaminant sources to avoid contamination of clean equipment.

2 - TYPES OF EQUIPMENT

Drilling equipment that must be decontaminated includes drill bits, auger sections, drillstring tools, drill rods, split barrel samplers, tremie pipes, clamps, hand tools, and steel cable. Decontamination of monitoring well development and ground-water sampling equipment includes submersible pumps, bailers, interface probes, water level meters, bladder pumps, air lift pumps, peristaltic pumps, and lysimeters. Other sampling equipment that requires decontamination includes, but is not limited to, hand trowels, hand augers, slide hammer samplers, shovels, stainless steel spoons and bowls, soil sample liners and caps, wipe sampling templates, COLIWASA samplers, and dippers. Equipment with a porous surface, such as rope, cloth hoses, and wooden blocks, cannot be thoroughly decontaminated and shall be properly disposed of after one use.

3 - FREQUENCY OF EQUIPMENT DECONTAMINATION

Down-hole drilling equipment and equipment used in monitoring well development and purging shall be decontaminated prior to initial use and between each borehole and well. However, down-hole drilling equipment may require more frequent cleaning to prevent cross-contamination between vertical zones within a single borehole. When drilling through a shallow contaminated zone and installing a surface casing to seal off the contaminated zone, the drilling tools will be decontaminated prior to drilling deeper. Groundwater sampling will be initiated by sampling ground water from the monitoring well where the least contamination is suspected. All groundwater, surface water, and soil sampling devices will be decontaminated prior to initial use and between collection of each sample to prevent the possible introduction of contaminants into successive samples.

4 - CLEANING SOLUTIONS AND TECHNIQUES

Decontamination can be accomplished using a variety of techniques and fluids. The preferred method of decontaminating major equipment such as drill bits, augers, drill string, pump drop-pipe, and others, is steam cleaning. Steam cleaning is accomplished using a portable, high-pressure steam cleaner equipped with a pressure hose and fittings. For this method, equipment will be thoroughly steam washed and rinsed with potable tap water to remove particulates and contaminants.

A rinse decontamination procedure is acceptable for equipment such as bailers, water level meters, new and re-used soil sample liners, and hand tools. The decontamination procedure will consist of the following steps:

1. Wash with a non-phosphate detergent (e.g., Alconox or Liquinox,) and potable water solution,
2. Rinse in a bath with potable water,
3. Spray with isopropyl alcohol,
4. Rinse in a bath with deionized or distilled water, and
5. Spray with deionized or distilled water.

If possible, equipment will be disassembled prior to cleaning. A second wash should be added at the beginning of the process if equipment is very soiled.

Decontaminating submersible pumps requires additional effort because internal surfaces become contaminated during usage. These pumps will be decontaminated by washing and rinsing the outside surfaces using the procedure described for small equipment or by steam cleaning. The internal surfaces will be decontaminated by recirculating fluids through the pump while it is operating. This recirculation can be done using a relatively long (typically 4 feet) large diameter pipe (4-inch or greater) equipped with a bottom cap. The pipe will be filled with the decontamination fluids, the pump placed within the capped pipe, and the pump operated while recirculating the fluids back into the pipe. The decontamination sequence will include

1. Detergent and potable water,
2. Potable water rinse,
3. Potable water rinse, and
4. Deionized water rinse.

The decontamination fluids shall be changed after each decontamination cycle.

Decontamination water will consist of distilled or deionized water. Steam-distilled water will not be used in the decontamination process as this type of water usually contains elevated concentrations of metals.

Equipment used for measuring field parameters such as pH, temperature, specific conductivity, and turbidity will be rinsed with deionized or distilled water after each measurement. New, unused soil sample liners and caps will also be washed with a fresh detergent solution and rinsed with potable water followed by distilled or deionized water to remove any dirt or cutting oils that may be on them prior to use.

Solvents other than isopropyl alcohol may be used, depending upon the contaminants involved. If polychlorinated biphenyls (PCBs) or chlorinated pesticides are contaminants of concern, hexane may be required as the decontamination solvent. Some decontamination solvents have health effects that must be considered. Use of these decontamination solvents will be specified in the project work plan.

5 - CONTAINMENT OF RESIDUAL CONTAMINANTS AND CLEANING SOLUTIONS

A decontamination program for equipment exposed to potentially hazardous materials requires a provision for catchments and disposal of the contaminated material, cleaning solution, and wash water.

When containing contaminated material and cleaning fluids from heavy equipment decontamination such as drill rigs and support vehicles, the area must be properly floored, preferably with a concrete pad that slopes toward a sump pit. If a concrete pad is impractical, planking can be used to construct solid flooring that is then covered by a nonporous surface and sloped toward a collection sump. If the decontamination area lacks a collection sump, plastic sheeting and blocks or other objects will be used to create a bermed area for collection of the equipment decontamination water. Items such as auger flights, which can be placed on metal stands or other similar equipment, should be situated on this equipment during decontamination to prevent contact with fluids generated by previous equipment decontamination. Clean equipment should be stored in a separate location to prevent recontamination. Decontamination fluids contained within the bermed area will be collected and stored in secured containers as described below.

Catchments of fluids from the decontamination of lighter-weight drilling equipment and hand-held sampling devices will be accomplished using wash buckets or tubs. The decontamination fluids will be collected and stored onsite in secured containers such as drums until their disposition is determined by laboratory analytical results. Containers will be labeled in accordance with OP-F1C, *IDW Management*.

6 - EFFECTIVENESS OF DECONTAMINATION PROCEDURES

A decontamination program must incorporate quality control measures to determine the effectiveness of cleaning methods. Quality control measures typically include collection of equipment rinsate samples or wipe testing. Equipment rinsates consist of analyte-free water that has been poured over or through the sample collection equipment after its final decontamination rinse. Wipe testing is performed by wiping a cloth over the surface of the equipment after cleaning. Further descriptions of these samples and their required frequency of collection is provided in OP-QC5, *Field QC Samples*. These quality control measures provide "after-the fact" information that may be useful in determining whether or not cleaning methods were effective in removing the contaminants of concern.

7 - RECORDS

The decontamination process will be described in the field logbook.

8 - HEALTH AND SAFETY

It is the responsibility of the Site Safety and Health Officer to set up the site zones (i.e., exclusion, transition, and clean) and decontamination areas. Generally the decontamination area is located within the transition zone, upwind of intrusive activities, and serves as the area where both personnel and equipment are washed to minimize the spread of contamination into the clean zone. For equipment, a series of buckets are set up on a polyethylene plastic-lined bermed area. Separate spray bottles containing isopropyl alcohol (or alternative cleaning solvent as described in the project work plan) and distilled water are used for final rinsing of equipment. Depending on the nature of the hazards and the site location, decontamination of heavy equipment such as augers, pump drop pipe, and vehicles may be accomplished using a variety of techniques.

Personnel responsible for equipment decontamination must wear the PPE specified in the site-specific Health and Safety Plan (HSP). Generally this includes at a minimum Tyvek® coveralls, steel-toed boots with boot covers or steel-toed rubber boots, safety glasses, ANSI-Standard hard hats, and hearing protection (if heavy equipment is in operation). Air monitoring (if required) may result in an upgrade to the use of half-face respirators and cartridges in the decontamination area; therefore, this equipment must be readily available. If safe alternatives are not achievable, site activities will be discontinued immediately.

In addition to the aforementioned precautions, the following safe work practices will be employed:

- Avoid skin contact with and/or incidental ingestion of decontamination solutions and water.
- Utilize PPE as specified in the site-specific HSP to maximize splash protection.
- Refer to material safety data sheets, safety personnel, and/or consult sampling personnel regarding appropriate safety measures (i.e., handling, PPE - skin, respiratory, etc.).
- Take necessary precautions when handling detergents and reagents.
- To avoid possible back strain, it is recommended that the decontamination area be raised 1 to 2 feet above ground level.
- To avoid heat stress, over exertion, and exhaustion, it is a recommended that equipment decontamination be rotated among all site personnel.
- Take necessary precautions when handling field sampling equipment.

9 - REFERENCES

OP-F1C, *IDW Management*

OP-QC5, *Field QC Samples*

U.S. Navy, 1996. Project Procedures Manual. U.S. Navy PACDIV Installation Restoration Program (IRP). September 1996.

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LOGBOOKS

1 - PURPOSE AND SCOPE

This operating procedure (OP) describes the identification, use, and control of logbooks and associated field data records.

This OP applies to all personnel involved with the use and control of logbooks and associated records pertaining to quality-related activities. It is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in the planning or execution of activities must be approved by the Project Manager.

The logbook user is responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature. The logbook user is also responsible for safeguard of the logbook while having custody of it.

2 - PROCEDURE

A field logbook is a bound notebook with water repellent pages, preferably with pre-numbered pages. The logbook serves as the primary record of field activities and as a permanent project record. Entries are made chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct each day's events. All field descriptions and observations are entered into the logbook using indelible black ink. Typical information to be entered includes, but is not limited to the following:

- Date and time of all onsite activities
- Site location and description
- Weather conditions
- Personnel present (including subcontractors)
- Field work documentation
- Field descriptions, equipment used, and field activities accomplished to reconstruct field operations
- Calibration records
- Field instrumentation readings
- Photograph references
- Sample locations
- Sample number and sample identification
- Sample naming
- Field QC sample information

- Field calculations
- PPE level
- Equipment decontamination procedures
- Meeting information
- Important times and dates of telephone conversations, correspondence, or deliverables
- Descriptions of and rationale for approved deviations from the work plan or sampling and analysis plan

In addition, field forms, such as soil boring logs, well completion logs, groundwater sampling forms, etc., will be used to record field data. The logbook will reference the data recorded on other field forms; likewise, the field forms shall reference the appropriate logbook page. If the logbook pages are not pre-numbered, page numbers shall be entered on the top outside corner of each page.

Any entry errors will be corrected by drawing a single line through the incorrect entry along with the person's initials and the date of the change. Corrections of more than a simple mistake will accompanied by an explanation, the initials of the person, and the date of the change.

At the end of each field day, the logkeeper will sign or initial the day's entries. If there is considerable space left on the last page of entry, a line will be drawn through the empty space and "NFA" for "No further action" will be written below the line, indicating the end of activities.

Preferably daily but at least weekly, the logbook shall be photocopied with the purpose of being a backup should the logbook become damaged or lost.

3 - DESCRIPTION OF LOGBOOK ENTRIES

The following are logbook entries and their descriptions that at a minimum shall be entered into the logbook for each field day, as applicable. An example of a logbook page in presented in Figure 1.

General Information

Date:	Date of field activities.
Site:	Project or site location.
Weather:	Indicate general weather and precipitation conditions at the site.
Activity:	Indicate field activity being performed. For example: Drilling, Trenching, Excavation, Soil Sampling, Well Installation, Well Development, Groundwater Sampling, Groundwater Monitoring, etc.
Activity Location:	Location as indicated in the sampling and analysis plan.

Personnel: List all members on the field team involved in the specified activity.

Equipment: List equipment used.

Subcontractor: Name all members of the subcontractor team involved in the specified activity and list the equipment used.

PPE Level: List the PPE Level (D, C, B or A) used during field activities and note any modifications made to the selected PPE level.

Sample Information

Sample Number: List the unique sample identification number associated with the physical samples. (Note: this may also be called an EPA number).

Descriptive Sample ID Number: If required in the sampling and analysis plan, list this additional sample descriptor.

Sample Type & Volume: Indicate the medium, container type, volume and preservatives (if any), for each sample. Identify QA and QC samples.

Sample Analysis: Indicate the analyses to be performed on each sample as specified in the sampling and analysis plan.

Entry Information

Time: Record the time the activity was performed (e.g., 0830, 1645). Use the 24-hour clock for recording the time.

Narrative: Create a factual, chronological record of the team's activities throughout the day, including the time and location of each activity. Include descriptions of any general problems encountered and their resolution. Provide the names and affiliations of non-field team personnel who visit the site, request changes in activity, impact to the work schedule, requested information, or observe team activities. Record any visual or other observations relevant to the activity, the contamination source, or the sample itself. It should be emphasized that logbook entries are for recording data and chronologies of events. The logbook author must include observations and descriptive notations, taking care to be objective and recording no opinions or subjective comments unless appropriate.

Field Measurements: Indicate measurements and field instrument readings taken during the activity.

References: If appropriate, indicate references to other logs or forms, drawings or photographs employed in the activity.

Recorded by:	Include the signature or initials of logkeeper responsible for the entries contained in the logbook and referenced forms.
No Further Action:	Include a line through any empty space below the last logbook entry of the day, and indicate an "NFA" for "No further action" below the line.

4 - REFERENCES

U.S. Navy, 1996. Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP). September 1996.

RECORD KEEPING, SAMPLE LABELING, AND CHAIN-OF-CUSTODY PROCEDURES

The purpose of this operating procedure (OP) is to establish standard protocols for all field personnel for use in maintaining field and sampling activity records, writing sample logs, labeling samples, completing chain-of-custody/analytical request forms, and ensuring that proper sample custody procedures are utilized.

Standards for documenting field activities, labeling the samples, documenting sample custody, and completing chain-of-custody/analytical request forms are provided in this procedure. The standards presented in this section will be followed to ensure that samples collected are maintained for their intended purpose and that the conditions encountered during field activities are documented.

This procedure will apply to all sample collection conducted during project activities and is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in the planning or the execution of activities must be approved by the Project Manager.

Responsibilities. Field personnel are responsible for following these procedures during sampling activities. Field personnel are responsible for recording pertinent data into the logbook to satisfy project requirements and for attesting to the accuracy of the entries by dated signature.

The Field Manager is responsible for ensuring that all field personnel follow these procedures.

The Project Manager and/or Project Chemist is responsible for verifying that the chain-of-custody/analytical request forms have been completed properly and match the sampling and analytical plan. The Project Manager and/or Project Chemist is responsible for notifying the laboratory, data managers, and data validators in writing if analytical request changes are required as a corrective action. The Project Manager is responsible for evaluating project compliance with these procedures.

1 - RECORD KEEPING

The field logbook serves as the primary record of field activities. Entries shall be made chronologically and in sufficient detail to allow the writer or a knowledgeable reviewer to reconstruct each day's events. Field logs such as soil boring logs and groundwater sampling logs will also be used. These procedures are described in OP-QC1, *Logbooks*.

2 - SAMPLE LABELING

A sample label with adhesive backing will be affixed to each individual sample container. Except for pre-weighed containers such as VOA vials, clear tape will be placed over each label to prevent the labels from tearing, smearing, falling off, and to prevent loss of information on the label. The following information shall be recorded with a waterproof marker on each label:

- Sample number
- Date and time of collection
- Sampler's initials
- Matrix (optional)
- Sample preservatives (if applicable)
- Analysis to be performed on sample (optional)

The above information will be handwritten or printed from a computer file onto adhesive labels procured commercially or obtained from the analytical laboratory.

3 - CUSTODY PROCEDURES

Sample custody procedures will be followed through the collection, transfer, analysis, and disposal to ensure that the integrity of the samples is maintained. Custody of samples will be maintained in accordance with chain-of-custody guidelines as prescribed in *Test Methods for Evaluating Solid Waste* (EPA 1986), *RCRA Ground-Water Monitoring: Draft Technical Guidance* (EPA 1992), and *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). A description of sample custody procedures is provided below.

3.1 Sample Collection Custody Procedures

A sample is considered to be in custody if:

- It is in one's actual physical possession or view
- It is in one's physical possession and has not been tampered with (i.e., it is under lock or official seal)
- It is retained in a secured area with restricted access
- It is placed in a container and secured with an official seal such that the sample cannot be reached without breaking the seal

Samples collected will be packaged in coolers for transport in accordance with the procedures described in OP-QC3, *Sample Handling*. Custody seals will be placed on the coolers when the cooler is to be removed from the sampler's custody. These seals are designed to enable detection of sample tampering. Custody seals will be placed in such a manner that they must be broken to open the cooler. The custody seals will be marked with the following information:

- Sampler's name or initials.
- Date and time that the cooler was sealed.

An example of a custody seal is shown in Figure 1.

Field personnel will log the individual samples onto chain-of-custody (COC) forms after a sample is collected. Completing a COC form initiates the documentation of the process of custody control, which includes possession of a sample from the time of its collection in the field to its receipt by the analytical laboratory, and through analysis and storage prior to disposal. These forms may also serve as the request for analyses.

Procedures for completing COC forms are discussed in Section 4. An example of a COC form is provided in Figure 2. The sampler will sign the COC form signifying that they were the personnel who collected the samples. The sampler will retain one copy of the form and the remaining copies of the form will be placed inside a self-sealing plastic bag and taped to the inside lid of the cooler containing the samples. Samples listed on a single COC form shall not be split into multiple coolers, however, samples on multiple COC form may be packaged together in a single cooler. Whenever a transfer of custody takes place, both parties will sign and date the accompanying COC forms, and the individual relinquishing the samples shall retain a copy of each form. One exception is when the samples are shipped via air freight; air courier personnel will not sign or receive a copy of the COC form because they do not open the coolers. The laboratory will include copies of the completed COC forms to the data packages containing the results of the analytical tests.

3.2 Laboratory Custody Procedures

The following are custody procedures to be followed by an independent laboratory receiving samples for chemical analysis. Each laboratory’s Quality Assurance Plan must follow these same procedures.

A designated sample custodian will take custody of all samples upon their arrival at the analytical laboratory. The custodian will sign and retain copies of the airway bills and COC forms. The custodian will inspect all sample labels and COC forms to ensure that the information is consistent, and that each is properly completed. The custodian will also measure the temperature of the samples in the coolers upon arrival. The custodian will note the condition of the samples received, including:

- If the samples show signs of damage or tampering
- If the containers are broken or leaking
- If headspace is present in sample vials
- If any sample holding times have been exceeded

The custodian will document all of the above information on a sample receipt sheet. Any discrepancy or improper preservation will be noted by the laboratory as an out-of control event and will be documented on an out-of-control form with corrective action taken (Figure 3). The out-of-control form will be signed and dated by the sample control custodian and any other persons responsible for corrective action.

The custodian will assign a unique laboratory number to each sample received and distribute the samples to secured storage areas, including those samples that must be maintained at 4°C or frozen. The unique laboratory number for each sample, the sample number, the client name, date and time received, analysis due date, and storage will be logged onto the sample receipt record and entered into the laboratory's computerized data management system.

Laboratory personnel will be responsible for the care and custody of samples from the time of their receipt at the laboratory through their exhaustion or disposal. Samples should be logged in and out on internal laboratory chain-of-custody forms each time they are removed from storage for extraction or analysis.

4 - COMPLETING CHAIN-OF-CUSTODY/ANALYTICAL REQUEST FORMS

Chain-of-custody forms also serve as analytical request forms. COC completion procedures are crucial in properly transferring the custody and responsibility of samples from field personnel to the laboratory, and for accurately and concisely requesting analyses for each sample.

COC forms can be tailored to a specific project, drafted, and printed onto multi-ply forms. This eliminates the need to rewrite redundant information on each COC form such as the analytical methods column headers, QC Level, TAT, project manager, and project name. Figure 4 is an example of a completed site-specific COC form, with box numbers identified and discussed below:

Box 1 **Project Manager:** The name that will appear on the report.

Project Name: Write it as it is to appear on the report.

Project Number: Write it as it is to appear on the report, i.e., task order number.

Box 2 **Bill to:** List the name and address of the person/company to bill only if it has not been included in the subcontract with the laboratory.

Box 3 **Sample Disposal Instructions:** These instructions will be stated in the Basic Ordering Agreement (BOA) or each project statement of work with the laboratory.

Shipment Method: State the method of shipment, e.g., hand carry; air courier via FED EX, AIR BORNE or DHL.

Comment: This area will be used by the field team to communicate observations, potential hazards, or limitations that may have occurred in the field, or additional information regarding analysis. For example: a specific metals list.

Box 4 **Cooler Number:** If multiple coolers are shipped together, each cooler may be numbered separately to avoid mixing up COC forms. Some laboratories attach this number to the trip blank identification which helps track VOA samples.

QC Level: Enter the reporting/QC requirements for data package contents.

Turn around time (TAT): TATs are project specific and must be negotiated with the laboratory prior to the start of sample collection. Standard turnaround times vary between 10 and 21 calendar days from receipt of the last sample. TATs are noted on each COC as a reminder to the laboratory.

Box 5 **Type of containers:** The type of container used (e.g., 1-liter glass amber) for a given parameter in that column.

Preservatives: Field personnel must indicate on the COC the preservative(s) used for the analysis requested. Indicate the temperature of the sample if it must be temperature controlled prior to extraction or analysis (e.g. 4^{o}C or frozen).

Box 6 **Sample number:** Alphanumeric identifier assigned to the samples. The number of characters used in this identifier is important since the labs are restricted to the number of characters they are able to use. See OP-F1D, *Sample Naming*.

Description: This can be used to indicate the location, a brief description, or an additional identification reference for the sample. This information does not need to be submitted to the laboratory but should be cross-referenced on a list of sample numbers maintained separately.

Date Collected: Collection date must be recorded in order to track the holding time of the sample. Note: For trip blanks, record the date it was placed in company with samples, usually first thing in the morning.

Time Collected: When collecting samples, record the time the sample is first collected. Use of the 24-hour military clock will avoid a.m. or p.m. designations; e.g., 1815 instead of 6:15 p.m. Record local time; the laboratory is responsible for calculating holding times to local time (Guam is 17 hours ahead of California during daylight savings time).

Lab Identification: This is for laboratory use only.

Box 7 **Matrix and QC:** Identify the sample matrix (e.g., water, soil, air, tissue, sediment, product, etc.). Mark an "X" for the sample(s) that have extra volume for laboratory QC matrix spike/matrix spike duplicate (MS/MSD) purposes. DO NOT indicate if a sample is a field duplicate on this form.

Box 8 **Analytical Parameters:** Enter the parameter by descriptor and the method number desired in the column header. For example, Figure 4 shows TPH 8015B; this is the analytical category followed by the SW-846 method number. Whenever possible, list the parameters as they appear in the laboratory subcontract to maintain consistency and avoid confusion. If requesting only part of standard list of analytes for an analytical method, specify the requested analytes in the comment section (e.g., lead only on an 6010B analysis for metals).

In the boxes below the analytical parameter, indicate the requested parameter for the samples by marking an "X" in the corresponding box.

Box 9 **Sampler's Signature:** The person who collected the samples must sign here.

Relinquished By: This space will contain the signature of the person who turned over the custody of the samples to a second party along with the date and time of the transfer. In many cases, it will be signature of the sampler.

Received By: Signature, date and time of the second party to receive the samples. This could be a representative of the analytical laboratory, a field crew member who will deliver the samples from the field to the laboratory or air courier, or the prime contracting laboratory when samples are to be sent to a subcontractor. Note: air freight couriers such as Federal Express or DHL generally do not sign this form because they do not open the coolers.

Relinquished By: This space will contain the signature of the person who turns custody of the samples over to a third party (if any).

Received By (Laboratory): This space is for the signature of a representative of the final destination, e.g., at a subcontracted laboratory.

Box 10 **Lab Number and Questions:** This box is to be filled in by the laboratory only.

Box 11 **Control Number:** This number is a unique "chain-of-custody" number assigned to each COC form. This control number must be unique, i.e., never used twice.

Date: Record the date the chain-of-custody is completed.

Box 12 **Total No. of Containers (last column):** For each sample number, sum the number of containers for that sample.

Box 13 **Total No. of Containers (bottom row):** Sum the number of containers in each column.

Chain-of-custody forms will have different formats depending upon who produced the form. While most of the information listed in Box 1 to 13 above will be required on all COC forms, some of the fields may not be required.

5 - RECORDS

Project personnel may fax a copy of COC forms to the laboratory as notification of shipment. The original chain-of-custody/analytical request form will be returned from the laboratory with the analytical data packages. Any change to the chain-of-custody/analytical request form that is made after the samples have shipped will be made in writing to the laboratory. A copy of this written change will also be sent to the data validators (if any) and placed in the project files. The reason for the change will be included in the project files so that recurring problems can be easily identified.

Following the completion of all project sampling activities, the sample logbook and copies of COC forms will be transmitted to the Project Chemist or Project Manager for storage in project files. The Project Chemist or Project Manager will review COC forms on a monthly basis or as required by the project work plan.

6 - HEALTH AND SAFETY

Not applicable.

7 - REFERENCES

OP-F1D, *Sample Naming*

OP-QC1, *Logbooks*

OP-QC3, *Sample Handling*

Environmental Protection Agency, United States (EPA). 1986. *SW-846 On-Line, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. 3rd edition. URL: <http://www.epa.gov/epaoswer/hazwaste/test/sw846.htm>. Office of Solid Waste.

EPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. Interim Final. EPA/540/G-89/004. Office of Emergency and Remedial Response. October.

EPA. 1992. *RCRA Ground-Water Monitoring: Draft Technical Guidance*. EPA 530/R-93-001. Office of Solid Waste. November.

U.S. Navy, 1996. Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP). September 1996.

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FIGURES

for

RECORD KEEPING, SAMPLE LABELING, AND CHAIN-OF-CUSTODY PROCEDURES

Sample Chain-of-Custody Seal

Sample Chain-of-Custody/Analytical Request Form

Sample Out-of-Control Form

Sample Completed Chain-of-Custody/Analytical Request Form

<table>
<tr><td rowspan="3">[LABORATORY]</td><td>SAMPLE NO.</td><td>DATE</td><td>SEAL BROKEN BY</td></tr>
<tr><td colspan="2">SIGNATURE</td><td>DATE</td></tr>
<tr><td colspan="3">PRINT NAME AND TITLE (Inspector, Analyst, or Technician)</td></tr>
</table>

Figure 1

Sample Chain-of-Custody Seal

Chain-of-Custody

Control Number:

Date: __________ Page: ____ of ____

PROJECT MANAGER:	BILL TO:	SAMPLE DISPOSAL:
PROJECT NAME:	COMPANY:	SHIPMENT METHOD:
PROJECT NUMBER:	ADDRESS:	COMMENTS:
Deliver results to the address above or as stated in the contract		
COOLER NUMBER:	CONTAINER # (water):	
QC LEVEL:	PRESERVATIVES:	

MATRIX / QC

Sample ID (EPA ID)	Sample ID (Navy IRP Use Only)	Date Collected	Time Collected	Lab ID	Soil	Water	Other (drum, sludge, etc.)	Field Duplicate (MS/MSD)	TPH 8015B	CLP VOAs	CLP SVOAs	CLP Pesticides	CLP Metals	EPA 8082 (PCBs)	EPA 8240	EPA 8270	EPA 6010 (Total Lead)					EXTRA VOLUME MS/MSD	HOLD	TOTAL # OF CONTAINERS
								TOTALS:																

Samplers Signature:	Date:	Time:
Relinquished By:	Date:	Time:
Received By:	Date:	Time:
Relinquished By:	Date:	Time:
Received By (LAB):	Date:	Time:

Original (white), Lab Copy (yellow), Field Copy (pink)

For Lab Use

Lab No.:

Does COC match sample: Y or N

Broken contaiiner: Y or N

Received within holding time: Y or N

COC seal intact: Y or N

Any other problems: Y or N

If problems, Client contacted: Y or N

Date contacted: ____________

Temperature (^{o}C): ____________

Figure 2

Sample Chain-of-Custody / Analytical Request Form

OUT OF CONTROL FORM	Status	Date	Initial
	Noted OOC		
	Submit for CA*		
	Resubmit for CA*		
	Completed		

Date Recognized:		By:	
Dated Occurred:		Matrix:	
Parameter (Test Code):		Method:	
Analyst:		Supervisor:	
1. Type of Event (Check all that apply)		2. Corrective Action (CA)* (Check all that apply)	
	Calibration Corr. Coefficient <0.995		Repeat calibration
	%RSD>20%		Made new standards
	Blank >MDL		Reran analysis
	Does not meet criteria:		Sample(s) redigested and rerun
	Spike		Sample(s) reextracted and rerun
	Duplicate		Recalculated
	LCS		Cleaned system
	Calibration Verification		Ran standard additions
	Standard Additions		Notified
	MS/MSD		Other (please explain)
	BS/BSD		
	Surrogate Recovery		
	Calculations Error		
	Holding Times Missed		
	Other (Please explain	Comments:	

Samples Affected (List by Accession AND Sample No.)

3. Results of Corrective Action	
	Return to Control (indicated with)
	Corrective Actions Not Successful - DATA IS TO BE FLAGGED with ____________.

Analyst:	Date:
Supervisor:	Date:
QA Department:	Date:

Figure 3

Sample Out-of-Control Form

Chain-of-Custody

11 Control Number:

Date: 01/17/02 Page: 1 of 1

PROJECT MANAGER:	Jane Smith
PROJECT NAME:	Former UST Location 1
PROJECT NUMBER:	TO 0029
Deliver results to the address above or as stated in the contract	
COOLER NUMBER:	0001 4
QC LEVEL:	Level III
TAT:	Normal - per contract

BILL TO:	
COMPANY:	Wil Chee - Planning, Inc. 2
ADDRESS:	1400 Rycroft St, #928 Honolulu, HI 96814

SAMPLE DISPOSAL:	by lab
SHIPMENT METHOD:	Express Courier 3
COMMENTS:	Measure cooler temperature at lab.

Sample ID (EPA ID) 6	Sample ID (Navy IRP Use Only)	Date Collected	Time Collected	Lab ID	Soil 7	Water	Other (drum, sludge, etc.)	Field Duplicate (MS/MSD)	TPH 8015B 8	CLP VOAs	CLP SVOAs	CLP Pesticides	CLP Metals	EPA 8082 (PCBs)	EPA 8240	EPA 8270	EPA 6010 (Total Lead)					EXTRA VOLUME MS/MSD	HOLD	TOTAL # OF CONTAINERS 12
					5 CONTAINER # (water):				4					4		2	2							
					PRESERVATIVES:				HCL															
WCP0001		01/17/02	1052		X				X					X		X	X							1
WCP0002		01/17/02	1127		X				X					X		X	X							1
WCP0003		01/17/02	1216		X				X					X		X	X							1
WCP0004		01/17/02	1332			X			X					X		X	X							6
WCP0005		01/17/02	1425			X			X					X		X	X							6
					13 TOTALS:				5					5		5	5							15

Samplers Signature:	Date:	Time:
Relinquished By: 9	Date:	Time:
Received By:	Date:	Time:
Relinquished By:	Date:	Time:
Received By (LAB):	Date:	Time:

Original (white), Lab Copy (yellow), Field Copy (pink)

For Lab Use

Lab No.: 10

Does COC match sample: Y or N

Broken contaiiner: Y or N

Received within holding time: Y or N

COC seal intact: Y or N

Any other problems: Y or N

If problems, Client contacted: Y or N

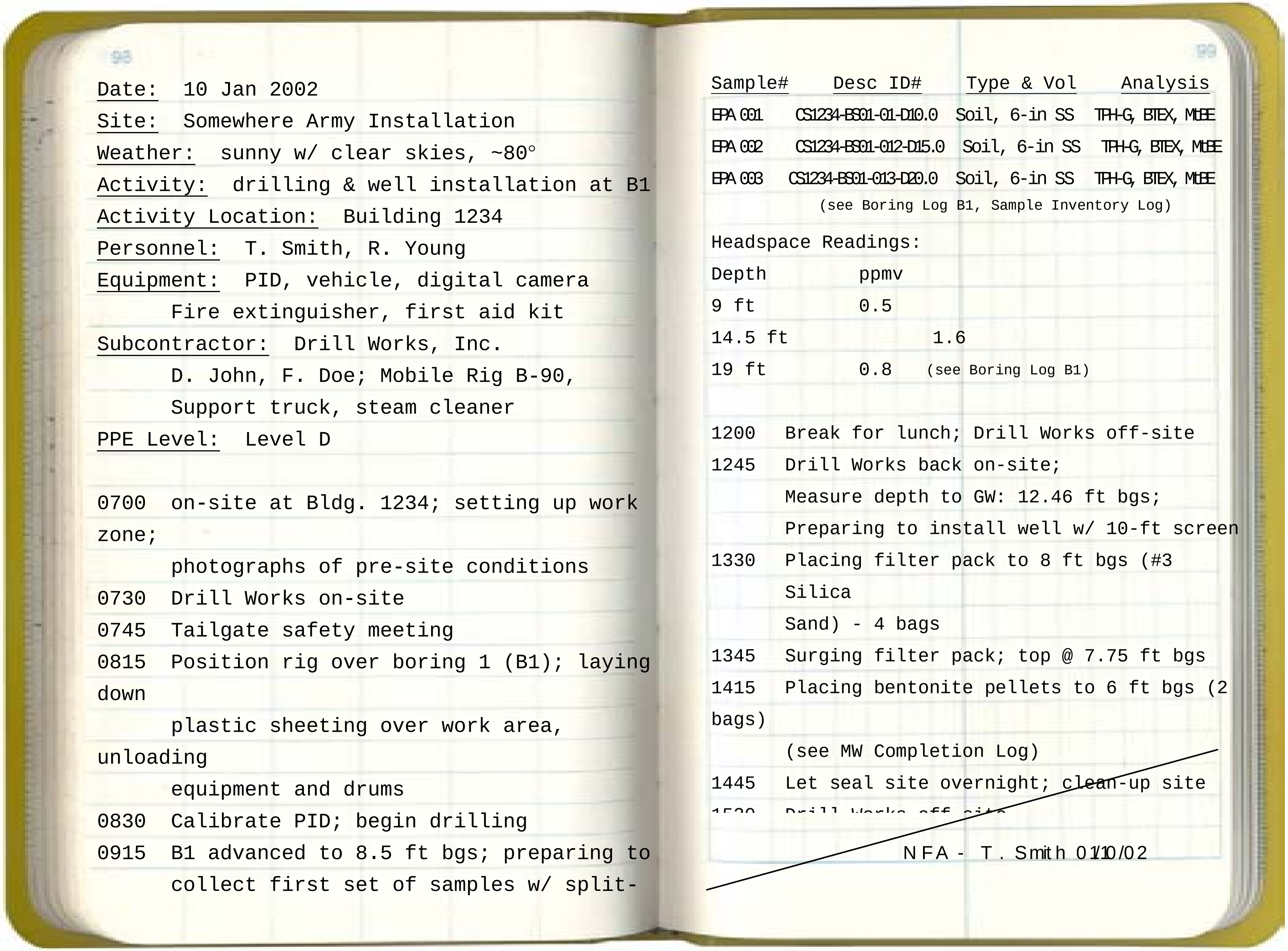
Date contacted: ______________

Temperature (^{o}C): ______________

Figure 4

Sample Completed Chain-of-Custody / Analytical Request Form

Figure 1: Sample Logbook Page.



SAMPLE HANDLING, STORAGE AND SHIPPING PROCEDURES

This operating procedure (OP) sets forth the methods for use by field personnel engaged in handling, storing, and shipping samples. This procedure applies to all samples and sample containers handled, stored, shipped, or otherwise transported during field activities. This procedure is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in planning or in the execution of planned activities must be approved by the Project Manager.

Responsibilities. The Field Manager and/or Project Chemist is responsible for ensuring that all samples are shipped according to this procedure. The Project Manager is responsible for identifying instances of non-compliance with this procedure and ensuring that future sample transport activities are in compliance with this procedure.

1 - HANDLING AND STORAGE

Immediately following collection, all samples will be labeled according to the procedures in OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*.

Samples collected for analysis at an off-site laboratory will be packaged in coolers. Cushioning material shall be placed on the bottom and top (and optionally on the sides) of the inside of the cooler. All empty space between sample containers will be filled with Styrofoam "peanuts" or other appropriate cushioning material.

Glass sample containers will be wrapped on the sides, tops, and bottoms with bubble wrap or other appropriate padding to prevent breakage during transport. All glass containers containing liquids must be packed in a upright position, never stacked or on their sides. An absorbent material (e.g., absorbent cloth material) will be placed on the bottom of the cooler to contain liquids in case of spillage.

Samples required to be stored at 4°C will be placed in insulated coolers with frozen gel packs (such as Blue Ice®) or wet ice packaged in double, sealed plastic bags (such as Ziploc®). Samples should occupy the lower portion of the cooler, while the ice should occupy the upper portion. Prior to shipment, the ice or gel packs in the coolers will be replaced so that samples will be maintained as close to 4°C as possible from the time of collection through transport to the analytical laboratory. Samples will be shipped on a schedule allowing the laboratory to meet holding times for analyses.

Upon receipt of sample coolers at the laboratory, the sample custodian will inspect the sample containers as discussed in OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*. The samples will be stored in a temperature-controlled storage area until they are removed for extraction and/or analysis.

2 - SHIPPING

All applicable United States (U.S.) Department of Transportation (DOT) regulations (49 Code of Federal Regulations (CFR), Parts 171-179) and International Air Transport Association (IATA) Dangerous Good Regulations (DGR) will be followed for the shipment of soil, water, air, and other environmental samples. Elements of these procedures are summarized below.

Shipments of samples originating in Hawaii and Pacific locations to analytical laboratories located in the continental U.S. are usually shipped via air couriers such as Federal Express or DHL. In these cases, the more stringent IATA regulations, applicable to air shipments only, must be consulted. References for both the DOT hazardous material and IATA dangerous good regulations will be cited. The terms “hazardous materials” and “dangerous goods” will be used interchangeably.

2.1 HAZARDOUS MATERIALS SHIPMENT

Field personnel must determine whether any sample is suspected to be a hazardous material. A sample should be assumed to be hazardous unless enough evidence exists to indicate it is non-hazardous. If samples are not suspected to be hazardous, shipments may be made as described in the Section 2.2 for non-hazardous materials, otherwise, the procedures summarized below must be followed.

Any substance or material that is capable of posing an unreasonable risk to life, health, or property when transported is classified as hazardous. Hazardous materials identification should be performed by checking the Hazardous Materials Table (49 CFR 172.102), the list of Dangerous Goods (DGR Section 4.2), or by determining whether the material meets the definition of any hazard class or division (49 CFR Part 173 and DGR Section 3).

All persons offering a hazardous material for shipment must be properly trained in the appropriate regulations, as required by 49 CFR 172.700 and/or Section 1.5 of the IATA DGR. The training must include a general awareness/familiarization of the regulations to enable employees to recognize and identify hazardous materials, safety training covering emergency response information and accident prevention procedures, and security awareness. Additional function-specific training may also be required depending on the functions each employee is responsible for performing.

When shipping hazardous materials by highway, rail or vessel, the proper shipping papers (49 CFR 172 Subpart C), package marking (49 CFR 172 Subpart D), labeling (49 CFR 172 Subpart E), placarding (49 CFR 172 Subpart F, if applicable), and packaging (49 CFR 173) must be used. When shipping hazardous materials by air, the proper packaging (DGR Section 5 and 6), marking and labeling (DGR Section 7) and shipping papers (DGR Section 8) must be used. Figure 1 shows an example of proper package markings.

According to Section 2.7 of the IATA Dangerous Goods Regulations (IATA, 2005), very small quantities of certain dangerous goods may be excepted from certain marking and documentation requirements when packaged, labeled, and transported as "Dangerous Goods in Excepted Quantities". Table 1 shows the volume or weight for different hazard classes of substances that qualify as excepted quantities. A "Dangerous Goods in Excepted Quantities" label must be completed and attached to the associated shipping cooler (Figure 2).

Certain preserved samples may not be regulated as hazardous materials. DOT issued an interpretation in February 2003 to the Environmental Protection Agency (Reference 02-0093) regarding the applicability of the Hazardous Materials Regulations to environmental samples preserved with corrosive materials. The interpretation states that environmental samples containing the following “upper limit” concentrations: 0.28 weight percent Nitric acid, 0.38 weight percent Sulfuric acid, 0.15 weight percent Hydrochloric acid, and 0.20 weight percent Sodium hydroxide, do not meet the definition of corrosive material in 49 CFR 173.136, and therefore, are not subject to the hazardous material regulations.

2.2 NON-HAZARDOUS MATERIALS SHIPMENT

If the samples are determined to be non-hazardous based on previous site sample results, field screening results, or visual observations, if applicable, then samples may be shipped as non-hazardous. All non-hazardous shipments will be packaged according to the procedures specified in Section 1, marked and labeled in accordance with the applicable requirements noted in Section 2.3. Figure 3 shows an example of a cooler prepared for non-hazardous materials.

2.3 SHIPMENTS FROM OUTSIDE THE CONTINENTAL UNITED STATES

Shipments of soil samples to the U.S. from locations outside the continental U.S. is controlled by the USDA and is subject to their inspection and regulation. Documentation in the form of a “USDA Soil Import Permit” (Figure 7) is required to prove that the receiving analytical laboratory is certified by the USDA to receive and properly dispose of foreign soil. A USDA representative will inspect the sample coolers and stamp the shipping documents prior to shipment.

Samples shipped from U.S. territories (e.g., Guam, Saipan, American Samoa) or foreign countries must be cleared by the U.S. Customs Service upon entry into the U.S. As long as a commercial invoice is properly completed (see Figure 5 and 6), shipments typically pass through U.S. Customs without the need to open coolers for inspection.

2.4 SUMMARY

When a cooler is ready for shipment to the laboratory, two copies of the chain-of-custody form shall be placed inside a self-sealing plastic bag and taped to the inside of the cooler lid. The cooler will then be sealed with waterproof tape. Applicable labels and marks such as "Fragile," "This-End-Up" or directional arrows pointing up, will be placed on the coolers as discussed in OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures*. If a shipment is made up of multiple pieces (e.g., more than one cooler), the paperwork need be attached only to one cooler, provided that the courier agrees. Custody seals are to be placed on each cooler to ensure proper chain-of-custody controls in the event coolers are opened for inspection. Figure 3 shows an example of how paperwork may be placed on the outside of coolers for non-hazardous materials. Figure 1 shows and example of labeling and marking requirements for shipments of hazardous materials.

Completion and use of proper paperwork will, in most cases, minimize or eliminate the need of the USDA and U.S. Customs to inspect the contents. The shipping paperwork listed below should be taped to the outside of the coolers to assist sample shipments.

- Courier Shipping Form - See Figure 4 for an example of the information to be included on these forms. Shipping forms shall be placed inside a clear plastic adhesive-backed pouch which adheres to the package (typically supplied by the courier), and placed on the cooler lid.
- Commercial Invoice (if required) – See Figures 5 and 6 for examples of the information to be included on these forms. Invoices shall be placed inside a clear plastic adhesive-backed pouch which adheres to the package (typically supplied by the courier), and placed on the cooler lid.
- USDA Soil Import Permits and USDA Labels (soil samples only) - See Figures 7 and 8 for examples. The laboratory must supply a copy of their USDA soil import permit prior to mobilization. The USDA in Hawaii often stops shipments of soil without these documents. The USDA soil permit should be placed inside a clear plastic adhesive-backed pouch which adheres to the cooler along with the shipping form. A 2” x 2” USDA label shall be placed on each cooler. It is recommended that a label also be stapled to the USDA soil permit also.
- Chain-of-Custody Seals - Custody seals shall be supplied by the laboratory. Field personnel must sign and date the seals. At least two seals shall be placed on the cooler in such a manner that they adhere to both the cooler lid and body. Placing the seals over the tape, then covering it with clear packing tape is suggested. This prevents the seal from coming loose and enables detection of tampering.
- Address Label - A label containing the laboratory address shall be affixed to each cooler.
- Special Marking and Labeling Requirements for Hazardous Materials – Additional markings and labels are required on coolers containing hazardous materials. Refer to Section 2.1.

3 - RECORDS

Records will be maintained as required by implementing these procedures.

4 - HEALTH AND SAFETY

1. Avoid lifting heavy coolers with back muscles; instead, use leg muscles or dollies.
2. Wear proper gloves, such as blue nitrile, latex, etc., as defined in the site-specific project Health and Safety Plan, when handling sample containers to avoid contacting any materials that may have spilled out of the sample containers.

5 - REFERENCES

International Air Transport Association (IATA), 2005. Dangerous Goods Regulations, 46th Edition. December 2005.

OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody Procedures.*

U.S. Navy, 1996. Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP). September 1996.

TABLES

For

SAMPLE HANDLING, STORAGE, AND SHIPPING PROCEDURES

IATA Excepted Quantity Limits

TABLE 1

IATA Excepted Quantity Limits

PACKING GROUP OF THE SUBSTANCE		PACKING GROUP I		PACKING GROUP II		PACKING GROUP III	
CLASS or DIVISION of PRIMARY or SUBSIDIARY RISK[Note A]		Packagings		Packagings		Packagings	
		Inner	Outer	Inner	Outer	Inner	Outer
1:	Explosives	FORBIDDEN					
2.1:	Flammable Gas	FORBIDDEN					
2.2:	Non-Flammable, Non-Toxic Gas	See Note B					
2.3:	Toxic Gas	FORBIDDEN					
3:	Flammable Liquid	30 mL	300 mL	30 mL	500 mL	30 mL	1 mL
4.1:	Self-reactive Substances	FORBIDDEN		FORBIDDEN		FORBIDDEN	
4.1:	Other Flammable Solids	FORBIDDEN		30 g	500 g	30 g	1 kg
4.2:	Pyrophoric Substances	FORBIDDEN		Not Applicable		Not Applicable	
4.2:	Spontaneously Combustible Substances	Not Applicable		30 g	500 g	30 g	1 kg
4.3:	Water Reactive Substances	FORBIDDEN		30 g or 30 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
5.1:	Oxidizers	FORBIDDEN		30 g or 30 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
5.2:	Organic Peroxides (Note C)	Not applicable		30 g or 30 mL	500 g or 250 mL	Not Applicable	
6.1:	Poisons – Inhalation Toxicity	FORBIDDEN		1 g or 1 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
6.1:	Poisons – Oral Toxicity	1 g or 1 mL	300 g or 300 mL	1 g or 1 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
6.1:	Poisons – Dermal Toxicity	1 g or 1 mL	300 g or 300 mL	1 g or 1 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
6.2:	Infectious Substances	FORBIDDEN					
7:	Radioactive Material (Note D)	FORBIDDEN					
8:	Corrosive Materials Note E	FORBIDDEN		30 g or 30 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L
9:	Magnetized Materials	FORBIDDEN (Note A)					
9:	Other Miscellaneous Materials (Note F)	Not applicable		30 g or 30 mL	500 g or 500 mL	30 g or 30 mL	1 kg or 1 L

Source: IATA, 2005.

Note A: The more restrictive quantity required by either the primary risk or where a Division 6.1 subsidiary risk label is required..

Note B: For inner packagings, the quantity contained in receptacle with a water capacity of 30 mL. For outer packagings, the sum of the water capacities of all the inner packagings contained must not exceed 1 L.

Note C: Applies only to Organic Peroxides when contained in a chemical kit or first aid kit.

Note D: See 10.5.9 radioactive material in excepted packages.

Note E: UN 2803 and UN 2809 are not permitted in Excepted Quantities.

Note F: For substances in Class 9 for which no packaging group is indicated in the List of Dangerous Goods, Packing Group II quantities must be used.

FIGURES

Example of Hazardous Material Package Marking

Label for Dangerous Goods in Excepted Quantities

Example of Non-Hazardous Material Cooler Marking for Shipment from Outside the Continental United States

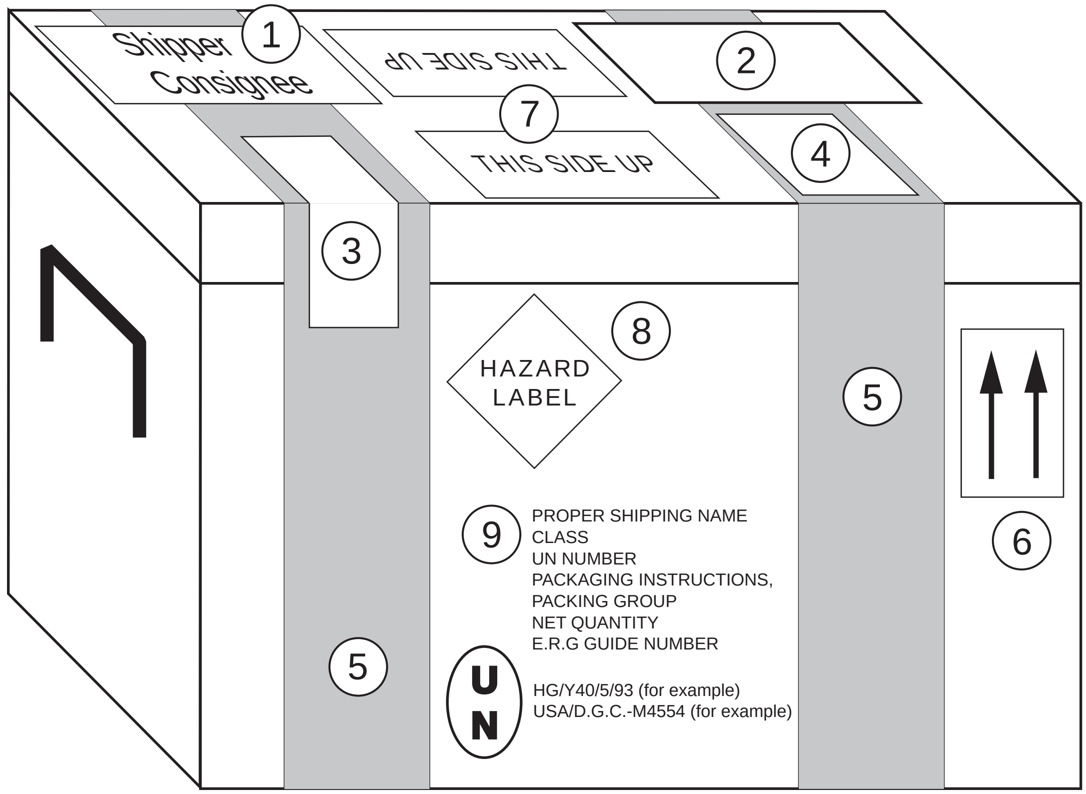
Example of Courier Form

Example of Commercial Invoice - Soil

Example of Commercial Invoice - Water

Example of Soil Import Permit

Soil Samples Restricted Entry Labels



1. Air Bill
2. USDA Soil Permit
3. Custody Seal
4. USDA 2" X 2" Soil Permit
5. Waterproofing Strapping Tape
6. Direction Arrow Sticker
7. This Side-Up Sticker
8. Hazard Label
9. Hazardous Material Information

Figure 1	Example of Hazardous Material Package Marking
	OP-QC3 SAMPLE HANDLING, STORAGE, AND SHIPPING PROCEDURES

DANGEROUS GOODS IN EXCEPTED QUANTITIES

This package contains dangerous goods in excepted small quantities and is in all respects in compliance with the applicable international and national government regulations and the IATA Dangerous Goods Regulations.

____
Signature of Shipper

________________________ ______________________
Title Date

____

____
Name and address of Shipper

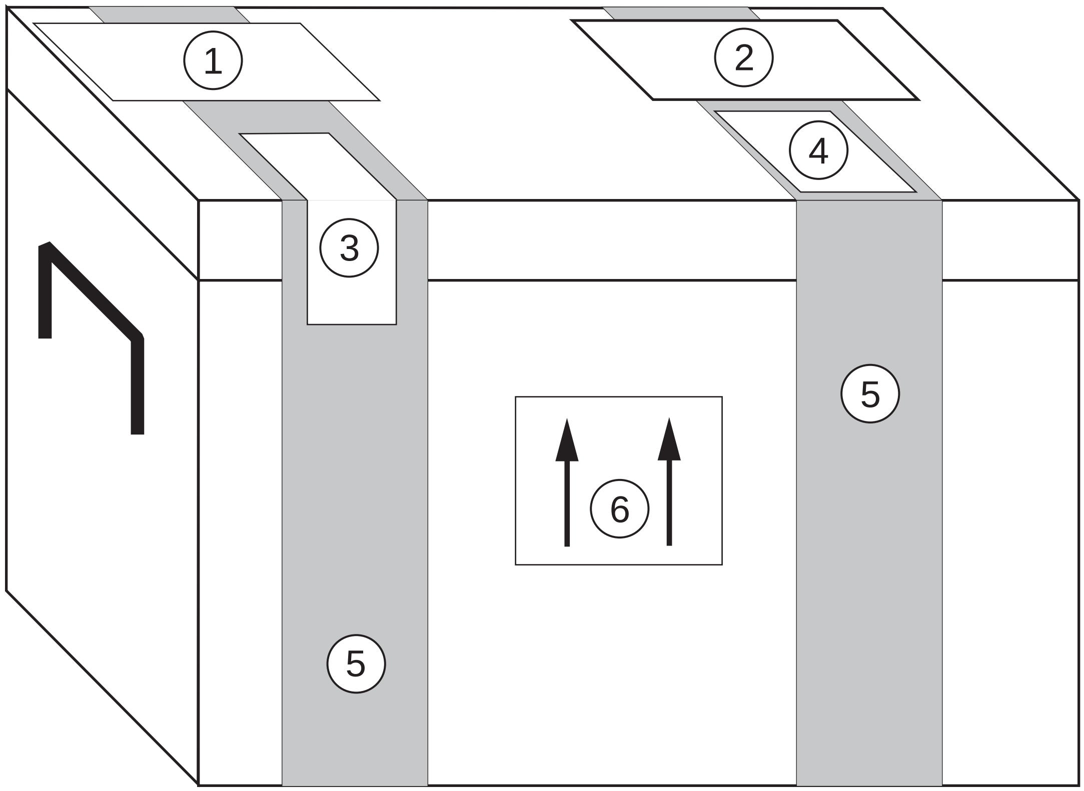
This package contains substance(s) in Class(es)
(check applicable box(es))

Class:	2	3	4	5	6	8	9
	☐	☐	☐	☐	☐	☐	☐

and the applicable UN Numbers are:

Figure 2

Label for Dangerous Goods in Excepted Quantities



1. Air Bill / Commercial Invoice
2. USDA Soil Permit (Letter to Laboratory from USDA)
3. Custody Seal
4. USDA 2" X 2" Soil Permit
5. Waterproofing Strapping Tape
6. Direction Arrow Sticker - Two Required

Figure 3

Example of Non-Hazardous Material Cooler Marking for Shipment from Outside the Continental United States


FedEx. USA Airbill Tracking Number 5454152874

0017232050 SPL11 Sender's Copy

1 From (please print)

Date Sender's FedEx Account Number XXXX-XXXX-X

Sender's Name John Doe Phone (808) 955-6088

Company WIL CHEE PLANNING

Address 1400 RYCROFT ST STE 928

City HONOLULU State HI Zip 96814

2 Your Internal Billing Reference Information

3 To (please print)

Recipient's Name Sample Receipt Phone < Laboratory Phone # >

Company < Laboratory Name >

Address < Laboratory Address >

City State Zip

For HOLD at FedEx Location check here

Hold Weekday Hold Saturday

For Saturday Delivery check here

Questions?
Call 1-800-Go-FedEx (1-800-463-3339)

The World On Time

4a Express Package Service

4b Express Freight Service

5 Packaging

6 Special Handling

7 Payment

Total Packages Total Weight Total Declared Value Total Charges

8 Release Signature

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Figure 4	Example of Courier Form
	OP-QC3 SAMPLE HANDLING, STORAGE, AND SHIPPING PROCEDURES

DATE OF EXPORATION	EXPORT REFERENCES (i.e., order no., invoice no., etc.)
01/01/02	< T.O. # >
SHIPPER/EXPORTER (completed name and address) John Doe Wil Chee-Planning, Inc. c/o < hotel name > < hotel address >	CONSIGNEE Sample Receipt < Laboratory Name > < Laboratory Address >
COUNTRY OF EXPORT Guam, USA	IMPORTER - IF OTHER THAN CONSIGNEE
COUNTRY OF ORIGIN OF GOODS Guam, USA	
COUNTRY OF ULTIMATE DESTINATION USA	

INTERNATIONAL AIR WAYBILL NO.		(NOTE: All shipments must be accompanied by a Federal Express International Air Waybill)

MARKS/NOS	NO. OF PKGS	TYPE OF PACKAGING	FULL DESCRIPTION OF GOODS	QTY	UNIT OF MEASURE	WEIGHT	UNIT VALUE	TOTAL VALUE
	3	coolers	soil samples for laboratory analysis only				$1.00	$3.00
	TOTAL NO. OF PKGS					TOTAL WEIGHT		TOTAL INVOICE VALUE
	3							$3.00

Check one
- ☐ F.O.B
- ☐ C & F
- ☐ C.I.F.

THESE COMMODITIES ARE LICENSED FOR THE ULTIMATE DESTINATION SHOWN.
DIVERSION CONTRARY TO UNITED STATES LAW IS PROHIBITED.

I DECLARE ALL THE INFORMATION CONTAINED IN THIS INVOICE TO BE TRUE AND CORRECT.

SIGNATURE OF SHIPPER/EXPORTER (Type name and title and sign).

John Doe, Geologist	John Doe	01/01/02
Name/Title	Signature	Date

Figure 5

Example of
Commercial Invoice - Soil

DATE OF EXPORATION 01/01/02	EXPORT REFERENCES (i.e., order no., invoice no., etc.) < T.O. # >
SHIPPER/EXPORTER (completed name and address) John Doe Wil Chee-Planning, Inc. c/o < hotel name > < hotel address >	CONSIGNEE Sample Receipt < Laboratory Name > < Laboratory Address >
COUNTRY OF EXPORT Guam, USA	IMPORTER - IF OTHER THAN CONSIGNEE
COUNTRY OF ORIGIN OF GOODS Guam, USA	
COUNTRY OF ULTIMATE DESTINATION USA	

INTERNATIONAL AIR WAYBILL NO.

(NOTE: All shipments must be accompanied by a Federal Express International Air Waybill)

MARKS/NOS	NO. OF PKGS	TYPE OF PACKAGING	FULL DESCRIPTION OF GOODS	QTY	UNIT OF MEASURE	WEIGHT	UNIT VALUE	TOTAL VALUE
	3	coolers	water samples for laboratory analysis only				$1.00	$3.00
	TOTAL NO. OF PKGS					TOTAL WEIGHT		TOTAL INVOICE VALUE
	3							$3.00

Check one
- ☐ F.O.B
- ☐ C & F
- ☐ C.I.F.

THESE COMMODITIES ARE LICENSED FOR THE ULTIMATE DESTINATION SHOWN.
DIVERSION CONTRARY TO UNITED STATES LAW IS PROHIBITED.

I DECLARE ALL THE INFORMATION CONTAINED IN THIS INVOICE TO BE TRUE AND CORRECT.

SIGNATURE OF SHIPPER/EXPORTER (Type name and title and sign).

Name/Title	Signature	Date
John Doe, Geologist	John Doe	01/01/02

Figure 6

Example of Commercial Invoice - Water

UNITED STATES
DEPARTMENT OF
AGRICULTURE

Animal and Plant
Health Inspection
Service

Plant Protection and
Quarantine

Soil Permit

Permit Number: S-73787

Issued To: STL Sacramento
(Karla Buechler)
880 Riverside Parkway
West Sacramento, California 95605

TELEPHONE: (916) 373-5600

Under the authority of the Federal Plant Pest Act of May 23, 1957, permission is hereby granted to the facility/individual named above subject to the following conditions:

1. Valid for shipments of soil not heat treated at the port of entry, only if a compliance agreement (PPQ Form 519) has been completed and signed. Compliance Agreements and Soil permits are non-transferable. If you hold a Soil Permit and you leave your present employer or company, you must notify your local USDA office promptly.
2. To be shipped in sturdy, leakproof, containers.
3. To be released without treatment at the port of entry.
4. To be used only for analysis and only in the facility of the permittee at STL Sacramento, located in West Sacramento, California.
5. No use of soil for growing purposes is authorized, including the isolation or culture of organisms imported in soil.
6. All unconsumed soil, containers, and effluent is to be autoclaved, incinerated, or heat treated by the permittee at the conclusion of the project as approved and prescribed by PPQ.
7. This permit authorizes shipments from all foreign sources, including Guam, Hawaii, Puerto Rico, and the U.S. Virgin Islands through any U.S. port of entry.
8. Permittee shall notify the Office of the Sacramento County Agricultural Commissioner upon arrival of shipment(s) at Area Code (916) 857-6603.

SEPTEMBER 30, 2010
Expiration Date

Lia Stewart
Approving Official LIA STEWART

WARNING: Any alteration, forgery, or unauthorized use of this Federal form is subject to civil penalties of up to $250,000 (7 U.S.C. § 7734(b)) or punishable by a fine of not more than $10,000, or imprisonment of not more than 5 years, or both (18 U.S.C. § 1001).

PPQ FORM 525B (8/94)

PART 1 - PERMITTEE

Figure 7

Example of Soil Import Permit

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
HYATTSVILLE, MARYLAND 20782

SOIL SAMPLES
RESTRICTED ENTRY

The material contained in this package is imported under authority of the Federal Plant Pest Act of May 23, 1957.

For release without treatment if addressee is currently listed as approved by Plant Protection and Quarantine.

PPQ FORM 550 (JAN 83) — *Edition of 12/77 may be used*

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
HYATTSVILLE, MARYLAND 20782

SOIL SAMPLES
RESTRICTED ENTRY

The material contained in this package is imported under authority of the Federal Plant Pest Act of May 23, 1957.

For release without treatment if addressee is currently listed as approved by Plant Protection and Quarantine.

PPQ FORM 550 (JAN 83) — *Edition of 12/77 may be used*

U.S. DEPARTMENT OF AGRICULTURE
ANIMAL AND PLANT HEALTH INSPECTION SERVICE
PLANT PROTECTION AND QUARANTINE
HYATTSVILLE, MARYLAND 20782

SOIL SAMPLES
RESTRICTED ENTRY

The material contained in this package is imported under authority of the Federal Plant Pest Act of May 23, 1957.

For release without treatment if addressee is currently listed as approved by Plant Protection and Quarantine.

PPQ FORM 550 (JAN 83) — *Edition of 12/77 may be used*

Figure 8

Soil Samples Restricted Entry Labels

FIELD QC SAMPLES

This operating procedure (OP) describes several types of soil and water field Quality Control (QC) samples that may be collected during site field work. While this procedure will apply to most sample collection activities, the number and type of QC samples will be project-specific, depending on the sample collection methods. Consult the project work plan for the number and type of QC samples required for each project before the start of fieldwork.

This procedure is not intended to obviate the need for professional judgment that may arise in unforeseen circumstances. Deviations from this procedure in the planning or execution of activities must be approved by the Project Manager.

Responsibilities. The Project Manager and/or Project Chemist are responsible for ensuring that field QC samples are collected and analyzed according to this procedure. The laboratory is responsible for ensuring that field QC samples are analyzed according to the specifications of the project Statement of Work and the analytical methods used.

1 - DEFINITIONS

Trip Blank. Trip blanks are samples that originate from ASTM Type II analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with samples to be analyzed for volatile organic compounds.

Equipment Rinsate Samples. An equipment rinsate (also known as a "decontamination rinsate," or "equipment blank") sample consists of analyte-free water that has been poured over or through the sample collection equipment after its final decontamination rinse. Analytical results of equipment rinsate samples are used to access equipment cleanliness and the effectiveness of the decontamination process.

Field Blanks. Field blanks are samples of the source water used as the final decontamination rinse water of sampling equipment, and should be from the same source water as used to generate the equipment rinsate sample.

Field Duplicate. A field duplicate is a second sample taken from the same source at the same time and analyzed under identical conditions to assist in evaluating sample variance. There are two types of field duplicates: replicates and collocates. Replicates are identical samples that have typically been homogenized, while collocates are samples collected next to each other (e.g., laterally or vertically, in separate containers, and not homogenized).

Reference Samples. Reference samples are samples taken from media similar to site media, but that are collected outside the zone of contamination. Reference samples are used to assist in evaluating background conditions.

2 - PROCEDURES

Field QC checks may include submission of trip blanks, equipment rinsates, field blanks, duplicates, and/or reference samples to the analytical laboratory. The number and types of field QC check samples will be specified in the project work plan. Different types of field QC samples are discussed below.

2.1 TRIP BLANKS

The laboratory prepares trip blanks using organic-free water. The trip blanks are sent to the field by the laboratory. Once prepared, trip blanks shall not be opened until they are returned to the laboratory.

Trip blanks will be placed in sample coolers prior to transport to the site so that they accompany the samples throughout the sample collection/handling/transport process. One set of two 40 milliliter vials will form a trip blank. Each cooler containing samples to be analyzed for volatile organics compounds (VOCs) by methods such as 8260B or modified 8015 for gasoline will require a trip blank. Results of trip blank analyses will used to assess whether samples have been contaminated by VOCs during sample handling or transport to the laboratory.

2.2 EQUIPMENT RINSATE SAMPLES

Equipment rinsate samples are collected by pumping or pouring the source water over and/or through the decontaminated sampling equipment. The source water may be poured by use of an electric or hand submersible pump by tipping the jug of water upside down, or by use of a stopcock and gravity. The runoff water is collected into the sample containers directly, or with the use of a sterile funnel if necessary.

The frequency of equipment rinsate sample collection and analysis will be specified in the project work plan. Generally, one equipment rinsate sample will be collected and analyzed per day for each sampling technique utilized that day. Rinsate samples will be analyzed for the same parameters as the samples collected utilizing a particular sampling method were analyzed. Results of rinsate samples are used to determine whether equipment decontamination was effective. If no analytes are found in the rinsate samples, the frequency of analysis and/or collection may be decreased. If analytes are found in the rinsate samples, decontamination procedures should be reviewed and modified as needed.

Generally, when disposable sampling equipment is utilized, equipment rinsate samples are not collected. Disposable sampling equipment is pre-cleaned and individually wrapped by the manufacturer prior to delivery to the site. As such, disposable sampling equipment is not likely to introduce contaminants to the samples via sampling equipment.

2.3 FIELD BLANKS

Field blanks consist of samples of the source water used as the final decontamination rinse water which is analyzed to assess whether the source water contained contaminants that may have been carried over into the site samples. Field blanks are collected simply by pouring the source water into sample containers.

The final decontamination rinse water source, the field blank source water, and equipment rinsate source water should all be from the same purified water source. Tap water used for steam cleaning augers or used in the initial decontamination buckets need not be collected and analyzed as a field blank, because augers typically do not touch the actual samples and because the final decontamination rinse water should be from a purified source.

The frequency of field blank collection and analysis will be stated in the project work plan. In general, field blanks should be collected and analyzed at a frequency of one per each source of water per sampling event. A sampling event is considered to be the time sampling personnel arrive at a site until they leave for more than one week. If the same lot of the water source is used, a field blank needs to be collected only once per lot. Field blanks will be analyzed for the same analytes as the samples collected.

2.4 FIELD DUPLICATES

Field duplicates consist of either collocated or replicate samples. The project work plan will specify the type and frequency of field duplicates to be collected. Collocated samples will be collected from adjacent locations or liners or water samples collected from the same well at the same time. Collocated samples provide information on the entire sample measurement system, including sampling, analysis, and non-homogeneities of the media sampled. Replicates are collected at the same time (e.g., homogenized or split samples), and provide information for various points in the analytical process. Sampling error can be approximated by the inclusion of collocated and replicated versions of the same sample.

Field duplicates for ground water and surface water samples will generally consist of replicates. Field duplicates for soil samples will consist primarily of collocates. Soil field duplicates that are to be analyzed for volatile constituents will consist only of collocates; no soil samples that are to be analyzed for volatiles will be replicated (i.e., homogenized or otherwise processed or split) in the field. A separate sample will be collected to provide duplicates for non-volatile analyses. The sample may be homogenized and split in the field to form an original and duplicate (replicate) sample, or an additional volume into a separate sample container may be collected to form a duplicate (collocate) sample. Alternatively, replicates may be formed by homogenization in the laboratory. Duplicates will be analyzed for the same analytical parameters as their associated original sample.

2.5 REFERENCE SAMPLES

Reference sampling is conducted to distinguish site-related contamination from naturally occurring or other non-site related levels of chemicals, i.e., to assess background levels. There are two types of background levels of chemicals:

- Naturally occurring levels, which are concentrations of chemicals present in the environment that have not been influenced by humans (e.g., metals such as iron or aluminum).
- Anthropogenic levels, which are concentrations of chemicals that are present in the environment due to human-made, non-site sources (e.g., industry, automobiles).

Site-specific conditions will dictate the number and type of reference samples necessary to characterize background concentrations of contaminants of concern. The number, type, and location of reference samples to be collected will be stated in the project work plan. Generally, reference samples are collected for each medium sampled at a site. The samples will be analyzed for all the analytes for which site samples of that medium are analyzed for.

3 - RECORDS

Records of the collection of field QC samples should be kept in the sample logbook in accordance with the procedures contained in OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody*.

4 - HEALTH AND SAFETY

The project Site Safety and Health Plan will be followed when collecting or working with potentially hazardous environmental samples.

5 - REFERENCES

OP-QC2, *Record Keeping, Sample Labeling, and Chain-of-Custody*

U.S. Navy, 1996. Project Procedures Manual, U.S. Navy PACDIV Installation Restoration Program (IRP). September 1996.

Attachment C
Analytical SOPs and Laboratory QC Limits

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ICP METALS ANALYSIS

Inductively Coupled Plasma -
Atomic Emission Spectroscopy (ICP-AES)

Methods EPA 6010 & EPA 200.7

Approved by:

Metals Group Leader / Date	QA Director/ Date

Read & Understood by:

Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date

Re-Approved by:

Signature/ Date	Signature/ Date

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ICP METALS ANALYSIS

Methods EPA 6010 & EPA 200.7

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ICP METALS ANALYSIS

Inductively Coupled Plasma - Atomic Emission Spectroscopy (ICP-AES)
Methods EPA 6010 & EPA 200.7

SCOPE

This document describes the analysis of waters, soils, and hazardous waste for inorganic elements by ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectrometry) methods EPA 6010B, and EPA 200.7 with additional guidance provided by EPA 6010C. Methods 6010B and 6010C were written by the EPA's Office of Solid Waste with additional guidance for surface water and ground water, as opposed to EPA 200.7 which was written by the EPA's Office of Water for wastewater and drinking water. EPA 200.7 may also be requested for groundwater samples if the client is planning to discharge the water, with or without additional treatment, into a wastewater stream or into naturally occurring surface waters (bay or river). See Appendix_11 for a summary of EPA 200.7 requirements.

In this analysis, analytes in solution are nebulized and transported to a plasma torch. The emission spectra is then measured by spectrometry. Background subtraction is used to reduce interferences contributed by the plasma gas, reagents, and sample matrix. No digestion required for dissolved metals. Acid digestion prior to analysis is required for total metals in water, soil, and wastes.

See Appendix_4 for reporting limits and Appendix_10 for a discussion of interferences.

REFERENCES

Analytical Method:
EPA 6010B, Inductively Coupled Plasma AE Spectrometry, SW-846 Update 3, Dec.1996
EPA 6010C, Inductively Coupled Plasma AE Spectrometry, SW-846 Update 4, Feb 2007
EPA 200.7, Determination of Metals/Trace Elements in Water/Wastes by ICP-AES, Rev. 4.4

Sample Prep Methods:
EPA 3010A, Acid Digestion of Aqueous Samples, SW-846 Update 3, Dec.1996
EPA 3050B, Acid Digestions of Sediments, Sludges, and Soils, SW-846 Update 3, Dec.1996
EPA 200.7, Determination of Metals… by ICP-AES, Rev. 4.4

Additional SOP's and Guidance Documents:
NELAC Chapter 5, Quality Systems, June 2003
DoD Quality Systems Manual, Version 4.1, April 2009
DoE Quality Systems Manual, Version 2.2, Oct.2006
C&T SOP QA 1.4, *Balance Calibration Check & Maintenance*
C&T SOP QA 1.5, *Calibrating & Maintaining Temperature Controls*
C&T SOP QA 1.6, *Pipet Calibration Check Procedures*
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C&T SOP QA 8.5.1, *DoD Program Requirements*
C&T QA SOP 8.6.1, *DoE Program Requirements*

PRESERVATION & HOLDING TIME

Preservation: HNO_3 to pH $\leq$ 2
Holding Time: 6 months

As of 4/11/07, 40CFR requires sample preservation to be performed within 15 minutes after collection of grab samples, composite samples, or aliquots taken from a composite taken automatically over time. For Dissolved Metals, the samples must be filtered and then preserved within 15 minutes of collection.

If a client requests that the lab filter the samples, a note to this effect should be placed in the case narrative. If the sample pH is >2 upon verification, EPA 200.8 requires that the sample be acidified to pH$\leq$2 *but* the lab must then wait 24 hours before verifying that the acidification was effective by rechecking the pH; if the pH was again >2, the process must be repeated.

SAFETY

Assume all samples, reagents and standards contain hazardous and/ or toxic material and take necessary precautions. Sample digests contain highly concentrated acids and should be handled with caution.

QC REQUIREMENTS

Project-specific quality assurance plans may have different criteria. If so, those requirements supersede this SOP for all samples related to that project.

a.) Initial Calibration:

An initial calibration (ICAL) curve consisting of a calibration blank and at least three standards must be established daily, prior to sample analysis. The lowest concentration standard must be at or below the reporting limit (see Appendix_4 for reporting limits) and the highest standard defines the top of the quantitation range. The correlation coefficient of this curve must be $\geq$ 0.995; if the calibration coefficient criterion is not met, the instrument must be recalibrated.

Note: for EPA 6010C the correlation coefficient of this curve must be $\geq$ 0.998; if the calibration coefficient criterion is not met, the instrument must be recalibrated.

b.) Calibration Verification:

An Initial Calibration Verification (ICV) standard obtained from a second supplier and Initial Calibration Blank (ICB) verification must be run at the beginning of each analytical run. A Continuing Calibration Verification (CCV) standard and Continuing Calibration Blank (CCB) verification must be analyzed after every 10 analytical samples, including batch QC samples, and at the end of the sequence.

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The concentration of the CCV is set at the midlevel of the calibration curve , with a tolerance of ± 10% of its true value for EPA 6010B and 6010C analysis and ± 5% for EPA 200.7. If any element falls outside these limits, all samples affected by the failure must be reanalyzed. An element may be reported in the event of a high failing CCV only if the sample result is determined to be less than the specified RL.

For EPA 6010C analysis: In addition to the midlevel ICV and CCV, a low level ICV should be run following initial calibration and a low level CCV should be run at the end of each sequence. The LLICV and LLCCV should be prepared at the limit of quantification (LOQ) for the calibration with a tolerance of ± 30% of its true value. Both the LLICV and LLCCV should be prepared from the same source as the calibration standards. If any element falls outside these limits, all samples affected by the failure must be reanalyzed. An element may be reported in the event of a high failing LLCCV only if the sample result is determined to be less than the specified RL An element may also be reported in the event of a failing LLCCV if the LOQ used for the sample result is greater than or equal to the level of a passing midlevel CCV or a passing LLCCV run at a higher concentration.

Note: For any Department of Defense (Navy, USACE, AFCEE) project that references the DoD Quality Systems Manual (QSM), the LLCCV must be within ± 20% of its true value.

Note: The USACE recommends that an ICAL standard, or a standard from the same manufacturer as the ICAL standards, be used for the CCVs, to more readily identify problems that are due to changing instrument conditions and are not due to differences between standards.

c.) Initial Calibration Blank (ICB) / Continuing Calibration Blank (CCB):
An initial calibration blank (ICB) verification must be run at the beginning of each analytical run, with the ICV. A continuing calibration blank (CCB) verification must be analyzed (with each bracketing CCV), after every 10 analytical samples, including batch QC samples, and at the end of the sequence. Target elements should not be detected in the CCB at any level above 3 times the Instrument Detection Limit (IDL).

Note: For any Department of Defense (Navy, USACE, AFCEE) project that references the DoD Quality Systems Manual (QSM), the ICB/CCB must be ND > LOD

d.) Interference Check Standard A (ICSA):
An interference check standard (ICS-A) containing only common interferents standard should be analyzed at the beginning of each sequence, after the calibration standards and verifications, to demonstrate that high levels of interferents are not significantly biasing sample results, in either a positive or negative fashion. The determined concentration of the non-interferent should be no more than ±RL in either direction.

Note: For any Department of Defense (Navy, USACE, AFCEE) project that references the DoD Quality Systems Manual (QSM), the measured concentrations of any elements that are not included in the ICS-A standard must be ND > LOD

e.) Interference Check Standard A-B (ICSAB):
An interference check standard (ICS-AB) containing both common interferents and low-level target analytes standard should be analyzed at the beginning of each sequence, after the calibration standards and verifications, to demonstrate that the interference corrections are effective and are correctly applied. The ICS-AB should also be analyzed at the end of the sequence to demonstrate that instrument conditions have not significantly changed over the course of the sequence - see *Note* below. The ICS-AB standard should contain interferent elements at concentrations greater than 100 ppm and the elements of interest at concentrations between 0.5 to 1.0 ppm.

The recovery for each element should be within 80-120% of the true value or subsequent sample results for that element cannot be reported.

Note: Although EPA 6010B does not require analysis of an ICS-AB at the end of the sequence, most Department of Defense (Army, Navy, etc) project plans include this requirement, so it is always a good idea to close the sequence with this standard.

f.) Batch QC:
The following quality control (QC) samples must be prepared in the same manner as the analytical samples at a rate of once per twenty or less samples for method 6010 and once per ten or less samples for method 200.7. C&T in-house acceptance limits are updated semi-annually; based on control charts of the previous year's data. See the associated SOP '*6010B QC Limits, Table-1'* for the current limits. For EPA 200.7, the QC recovery limits are specified in the method and can be found in Appendix 11.

Note: Project-specific quality assurance plans may have different criteria. If so, those requirements supersede this SOP for all samples related to that project.

Method Blank (BLANK): The purpose of the method blank is to ensure that the digestion and analysis process does not in any way contaminate the analytical samples. Deionized water is carried through the entire digestion process and analyzed. The results for the preparation blank should be <1/2 RL and must be < RL for all target elements. If the sample result for that compound(s) is greater than ten (10) times the amount found in the method blank, document the contamination on the batch sequence summary and the data review checklist and report the data without reanalysis. If the sample result for that compound(s) is greater than the reporting limit but less than ten (10) times the amount found in the associated method blank, the samples must be re-digested and reanalyzed

EPA 200.7 Method Note: Method 200.7 requires redigestion and reanalysis of any sample associated with a method blank containing laboratory contamination greater than 2.2x the MDL for that element and <10x the concentration in the sample. If the sample is ND for the blank contaminant or is >10x the level found in the blank, the sample may be

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reported without corrective action.

Blank Spike (BS) and Blank Spike Duplicate (BSD): The purpose of the blank spikes is to demonstrate that the sample preparation and analysis procedures are accurate (recovery) and precise (RPD) in the absence of matrix interferences. A known concentration of each element is added to deionized water and carried through the entire digestion and analysis process.

For EPA 6010, the recoveries and RPD should fall within C&T in-house limits, or the samples associated with it should be redigested and reanalyzed. For EPA 200.7, the recoveries must fall within 85-115%.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD): The purpose of the matrix spikes is to demonstrate that the sample preparation and analysis procedures are accurate (recovery) and precise (RPD) in the possible presence of matrix interferences. A known concentration of each element is added to a real-world sample and carried through the entire digestion and analysis process.

For EPA 6010, the recoveries and RPD should fall within inhouse acceptance limits. For EPA 200.7, the recoveries should fall within 70-130%. If recovery limits are not met, an acceptable explanation and narration, or redigestion of samples is required. If the concentration of any element in the spiked sample is greater than four times the spiking level, the recovery is considered ‘Not Meaningful’ and LIMS will place an “NM” flag on the report.

Sample Duplicate (SDUP): For leachates or other samples known to contain high levels of target analytes, a sample duplicate and sample spike may be analyzed in place of the MS/MSD. The selected sample is prepared and analyzed in duplicate to determine the precision of the sample preparation and analysis process in the presence of potential matrix interferences. If the RPD exceeds C&T RPD limits for a majority of the analytes of interest, the source of the error must be identified and narrated or the affected samples redigested.

Sample Spike (SSPIKE): A second aliquot of a sample is spiked with a known concentration of elements to determine the accuracy of the sample preparation and analytical process in the presence of potential matrix interferences. If C&T recovery limits are not met, an acceptable explanation and narration, or redigestion of samples is required. If the concentration of any element in the spiked sample is greater than four times the spiking level, the recovery is considered ‘Not Meaningful’ and LIMS will place an “NM” flag on the report.

g.) Sample Interference Verifications:
The method recommends that whenever a new or unusual matrix is encountered, a series of tests be performed to ensure that neither positive nor negative interferences are distorting the accuracy of the reported values. These are optional steps that should be implemented

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for any batch containing “Level 3” or Level 4” samples, as nearly all Department of Defense project plans include this requirement. These should also be analyzed whenever the analyst suspects that sample viscosity, salt content, or other matrix interferences are likely.

Serial Dilutions: Analysis of a 5x dilution should agree within ± 10% (90-110% recovery) of the original determination if the concentration of the element in diluted aliquot is greater than the reporting limit. If not a chemical or physical interference should be suspected.

EPA 200.7 method note: Serial Dilution recovery limits are 95-105%.

Post Digest Spikes: An analyte spike added to a portion of a prepared sample digest, or its dilution, should be recovered to within 75-125% of the known value. The spike addition should produce a minimum level of 10 times and a maximum level of 100 times the instrumental detection limit. If the spike is not recovered within the specified limits a matrix effect should be suspected.

EPA 200.7 method note: Post Digestion Spike recovery limits are 90-110%
EPA 6010C method note: Post Digestion Spike recovery limits are 80-120%.

h.) Multi-Spectral Fitting (MSF):
MSF is a method of correcting for spectral overlap of interferents with the analyte of interest by collecting spectra of a blank, analyte, and individual solutions of each interferent. In MSF models, all components are assumed to be linearly independent and the MSF is then independent of concentration or plasma effects. This method cannot be used if the spectra of two analytes directly overlap, but is the preferred method for those analytes whose spectra are even slightly offset.

i.) Inter-Element correction (IEC) factors:
An IEC is a method of correcting for the spectral overlap of high levels of interfering elements, upon the analyte of interest, in those instances where Multi-Spectral Fitting cannot be applied. Mathematical correction factors are applied to the emission intensities. IEC’s are limited in that the interfering element must be within the linear range and the plasma conditions must not be changed. The IEC’s are determined through analysis of single-element standards and examination of the resulting data against the intensities collected at the remaining wavelengths to determine what other elements may be affected by a high level of that element. Any IEC’s must be applied where needed and updated every six months or when an instrument change occurs in the torch, nebulizer, injector, optics, or plasma condition.

j.) Method Detection Limit (MDL):
MDL studies must be performed annually for each instrument and matrix, in order to demonstrate that the sample preparation and analysis procedures are adequate to meet required reporting limits. The MDL is determined by digesting and analyzing at least 7

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replicates of a low-level blank spike, determining the standard deviation for each element, and applying a multiplier. See the QA SOP "Determining MDLs" for details.

k.) Instrument Detection Limit (IDL):
The DOD-QSM and EPA 200.7 require that IDL studies be performed quarterly for each instrument. Because method EPA 6010B does not discuss IDL's, C&T follows the procedure described in EPA 6020 Section 8.2 and determines the IDL by analyzing seven instrument blanks (that have *not* been digested), on each of three non-consecutive days. The standard deviation of the calculated concentrations is determined for each day; the IDL is the average of the three standard deviations. The IDL must be less than the water MDL for that instrument.

l) **Limit of Detection (LOD)** must be determined quarterly and is based on a laboratory control sample (MDL check sample) that is spiked 2 to 4 times the MDL, digested and analyzed on every instrument. See the QA SOP for Method Detection Limits for details.

m.) **Limit of Quantitation (LOQ)** must be determined quarterly and is based on a laboratory control sample that is spiked 1 to 2 times the reporting limit. It is only analyzed once per method. See the QA SOP for Limit of Quantitation for details.

EQUIPMENT
MET-08: Perkin-Elmer ICP, Model 5300 DV with CETAC autosampler
MET-09: Perkin-Elmer ICP, Model 5300 DV with AS93Plus autosampler
WinLab 32, Perkin-Elmer Data Acquisition Software, Version 3.0

DAILY MAINTENANCE
- Replenish the rinse-water reservoir daily with 2% HNO_3 - 2% HCl.
- Change the pump windings for the internal standard solution every day or two.
- Change the sample tubing every 1 to 2 weeks, or whenever bubbles appear in the lines.

DAILY INSTRUMENT SEQUENCE
1) Turn the ICP on and allow the instrument to stabilize for about 30 minutes, or longer (up to 90 minutes) when the pump windings have been changed. See Appendix 8 for instrument start-up procedures.

2) Verify that the lamp is correctly aligned, as described in Appendix 8.

3) Calibrate the ICP by running a calibration blank followed by at least three calibration standards, in increasing order of concentration, at levels that bracket the quantitation range; the lowest standard must be at or below the reporting limit and the highest standard determines the upper end of the quantitation range (see Appendix 3).

4) Send the calibration data files to LIMS, as described in Appendix 8.

5) Review the ICAL summary to determine if the sequence can be continued:

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- The percent RSD should be $\leq$ 5% for the three replicate exposures of each standard. See Appendix_8 for software instructions.

  EPA 200.7 note: The RSD limit is $\leq$ 3%.

- The correlation coefficient for each element must be $\geq$ 0.995.

  EPA 6010C note: The correlation coefficient must be $\geq$ 0.998.

- The highest concentration standard may be omitted so as long as there are at least three points remaining and the remaining highest point defines the top of the calibration range (any digests which exceed this concentration must be diluted and reanalyzed).

- The lowest concentration standard may be omitted from curve if, *and only if*, the resulting lowest standard is at or below the reporting limit for samples and there are at least three points remaining.

- Mid-point standards may not be omitted simply to improve the correlation coefficient. They may, however, be reanalyzed if poor aspiration is suspected. The reanalysis must occur immediately after the curve so long as no sample digests were analyzed since the last calibration standard and all elements are calibrated using the second run. Under no circumstances may a point in the middle of the curve be rejected in order to pass calibration criteria for a particular element.

6) Verify the calibration curve by running an ICV standard (obtained from a different manufacturer from the calibration standard) for all elements of interest. The ICV %D's must fall within acceptance limits for the elements of interest before analysis can proceed. See Appendix_3 for the concentrations in this standard.

   6010 Limits: 90-110% recovery
   200.7 Limits: 95-105% recovery

7) **For EPA 6010C analysis:** Analyze a low level ICV (LLICV) after running the initial calibration and at the end of each batch or sequence. The LLICV should be prepared at the limit of quantification (LOQ) for the calibration with a tolerance of $\pm$ 30% of its true value. The LLICV should be prepared from the same source as the calibration standards. If any element falls outside these limits, all samples affected by the failure must be reanalyzed. An element may be reported in the event of a high failing LLICV only if the sample result is determined to be less than the specified RL An element may also be reported in the event of a failing LLICV if the LOQ used for the sample result is greater than or equal to the level of a passing midlevel CCV or a passing LLICV run at a higher concentration.

   Note: For any Department of Defense (Navy, USACE, AFCEE) project that references the DoD Quality Systems Manual (QSM), the LLICV must be within $\pm$ 20% of its true

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value.

8) Analyze an Instrument Calibration Blank (ICB), consisting of deionized water acidified with 5% HCl and 5% HNO_3. Target elements should not be detected in the ICB at any level above 3 times the Instrument Detection Limit (IDL).

Note: For any Department of Defense (Navy, USACE, AFCEE) project that references the DoD Quality Systems Manual (QSM), the ICB/CCB must be ND > LOD

9) Analyze the ICS-A to demonstrate that high levels of interferents are not biasing low-level quantitation. The determined concentration of the non-interferent should be $\leq$RL in either direction (+/-), except for those elements that are considered by the manufacturer to be 'trace' contaminants of the high level elements and are listed on the Certificate of Analysis. If this standard fails acceptance criteria, check the interference corrections (MSF); update the MSF if necessary and reprocess the sequence to that point.

Note: For any Department of Defense (Navy, USACE, AFCEE) project that references the DoD Quality Systems Manual (QSM), the measured concentrations of any elements that are not included in the ICS-A standard must be ND > LOD.

10) Analyze the ICS-AB to demonstrate that quantitation in the presence of high-level interferents is acceptably accurate. The results for the non-interferent elements in the ICSAB must be within $\pm$ 20% of the true values (80-120% recovery). If this standard does not meet the acceptance criteria, the analysis must be terminated, the method corrected for the interference, and the analysis restarted from calibration.

11) Now after all of this QC, real samples may be run. Collect the digestates, job sheets, LIMS prep sheet, and copy of the benchbook page from the prep chemists. Sign the "Received by" line on the LIMS prep sheet to maintain internal chain-of-custody of the digestates.

12) Decant the digestates into labeled autosampler tubes.

Note: Analyze leachates at a 10x dilution so the high salt content of the leaching fluid will not 'salt out' in the aspirator and clog the injection system.

13) Choose a sample for the serial dilution and post-digestion spike; this sample is usually the same sample used for the MS/MSD, but may be different if requested by a client.

12.1) Prepare the Serial Dilution by measuring 2.0 mL of the sample digestate into a disposable centrifuge tube labeled with the sample number and "SD". Add 8.0 mL of acidified (5%HCl, 5%HNO_3) deionized water. Cap and invert several times to mix.

Enter the serial dilution into the LIMS 'Prep Entry' table, using the same mass:volume as the original sample. In the instrument sequence, enter it using the stype 'SER' (like 'BS'), with an instrument dilution factor of 5.

12.2) Prepare the Post-Digestion Spike by measuring 10.0 mL of the sample digestate into a disposable centrifuge tube labeled with the sample number and "PDS". Add 0.10mL of the same spike used for the MS/MSD. Cap and invert several times to mix.

Enter the post-digestion spike into the LIMS 'Prep Entry' table, using the same mass:volume as the original sample. In the sequence, enter it using the stype 'PDS' along with the LIMS S# of the spiking standard used, and a dilution factor of 100 for the spiking standard.

14) After ten samples are analyzed, and at the end of the analytical run, the calibration curve must be re-verified by running a Continuing Calibration Verification (CCV) and a Continuing Calibration Blank (CCB). Note that the ICS-A and ICS-AB are considered analytical samples in the first group of ten samples.

See Appendix_8 for instructions on setting up an autosampler sequence. A typical analytical sequence is shown below:

Calibration Blank
Calibration Standard, low level
Calibration Standard, mid-level
Calibration Standard, high level
Instrument Blank
Initial Calibration Verification (ICV)
Initial Calibration Blank (ICB)
Interference Check Standard A (ICSA)
Interference Check Standard A+B (ICSAB)
Method Blank
Blank Spike
Blank Spike Duplicate
Sample Duplicate
Sample Spike
.. 3 more samples ..
Continuing Calibration Verification Standard (CCV)
Continuing Calibration Blank (CCB)
.. 10 samples ..
Continuing Calibration Verification Standard (CCV)
Continuing Calibration Blank (CCB)
.. 10 samples ..
Interference Check Standard A+B (ICSAB)
Continuing Calibration Verification Standard (CCV)

Continuing Calibration Blank (CCB)

The sequence must end with a CCV and CCB, regardless of the number of samples that have been analyzed.

Note: Although EPA 6010B does not require analysis of an ICS-AB at the end of the sequence, EPA 200.7 and most Department of Defense (Army, Navy, etc) project plans include this requirement, so it is always a good idea to close the sequence with this standard. If an element does not fall within 80% - 120% all samples analyzed for that element must be reanalyzed.

QUANTITATIVE ANALYSIS

The Perkin-Elmer ICP automatically adds internal standard (Yttrium), which helps compensate for viscosity and transport interferences. The sample is then transported through the nebulizer and vaporized in the plasma. The spectrometer measures the changing intensity of the selected wavelength either radially (across the radius of the plasma) or axially (along the radius of the plasma). For all samples and standards, the instrument collects information for three exposures and reports the average intensity of these exposures, along with the %RSD between the exposures.

Quantitation is based on comparison of the intensity of the target element and internal standard to the initial calibration curve for that element, with adjustments for the sample preparation concentration factor and instrument dilution factor. The intensity reading on the Perkin-Elmer software hardcopy report is the “corrected” intensity that has already been adjusted for the internal standard response; see Appendix_8 for instructions to view or print the raw, uncorrected intensities. See Appendix_1 for example calculations. Concentrations are expressed as micrograms per liter (µg/L) or milligrams per kilogram (mg/kg).

All results are reported on a wet-weight (“as received”) basis unless otherwise requested by the client. If the client requests ‘dry-weight’ corrections, the ‘wet-weight’ results in the results database are corrected for moisture by LIMS when producing the final report forms.

1.) Evaluate the Internal Standard Recoveries

The Yttrium internal standard recovery should be between 30-200% for all standards and samples, or that data should be considered suspect and those standards or digestates rerun. If the affected run is a CCV or CCB, all samples bracketed by that run should also be rerun.

Note: The 30-200% limits specified above are C&T’s in-house limits, as EPA 6010B does not specify internal standard recovery limits.

2.) Evaluate the CCV’s

Target elements must not be detected in the calibration blank at any level greater than the reporting limit. The concentration of the CCV must be varied within the calibration range, over the course of the sequence, with recoveries between 90-110% (or 95-105% for EPA 200.7). If the %D for any element is outside this acceptance window, LIMS will use the following to determine if the associated results are reportable:

- If the failing element is not a target analyte for the associated samples, sample results should be reported without reanalysis.
- If the compound fails the %D criterion due to a high response but was not detected above the reporting limit in the associated samples, the sample results may be reported without reanalysis, as the high bias does not affect the sample results.
- If the compound fails the %D criterion due to a high response and *was* detected above the reporting limit in any of the associated samples, the samples must be reanalyzed.
- If the compound fails the %D criterion due to a low response, the sample must be reanalyzed as the low bias may result in false negatives or misquantitation.

Reported sample and batch QC results must be bracketed by acceptable calibration verification standards and blanks.

3.) For EPA Method 6010C, Evaluate the LLCCV

Analyze a low level CCV (LLCCV) following the ICV and after each batch or sequence. The LLCCV should be prepared at the limit of quantification (LOQ) for the calibration with a tolerance of ± 30% of its true value. The LLCCV should be prepared from the same source as the calibration standards. If any element falls outside these limits, all samples affected by the failure must be reanalyzed. An element may be reported in the event of a high failing LLCCV only if the sample result is determined to be less than the specified RL An element may also be reported in the event of a failing LLCCV if the LOQ used for the sample result is greater than or equal to the level of a passing midlevel CCV or a passing LLCCV run at a higher concentration.

Note: For any Department of Defense (Navy, USACE, AFCEE) project that references the DoD Quality Systems Manual (QSM), the LLCCV must be within ± 20% of its true value.

4.) Evaluate the Batch QC Results

- **Prep Blank:** The results for the preparation blank should be <1/2RL and must be <RL for all target elements. If reanalysis confirms the contamination, use the following steps to determine if the sample results may be reported:

  a. If the concentration of the contaminant is below the reporting limit but above 1/2 of the reporting limit, document the contamination on the batch sequence summary and the data review checklist and report the data without reanalysis.

b. If the target element(s) found in the blank was not detected in the associated samples, the data may be reported and the problem narrated.

c. If the target element(s) found the method blank was also detected in the associated samples, but the level in the samples is greater than 10x the level in the blank, document the contamination on the batch sequence summary and the data review checklist and report the data without reanalysis.

d. If the target element(s) detected in the blank were also detected in the associated samples, but at levels less than 10x the level in the blank, and reanalysis confirms the problem, the samples containing the contaminant must be re-batched and reanalyzed. Initiate a Corrective Action Report (CAR) immediately so that re-digestion can begin within the clients requested turn-around time, if necessary.

Note: EPA 200.7 requires redigestion and reanalysis of any sample associated with a method blank containing laboratory contamination greater than **2.2x the MDL** for that element and <10x the concentration in the sample. If the sample is ND for the blank contaminant or is >10x the level found in the blank, the sample may be reported without corrective action.

- **Blank Spike (BS) and Blank Spike Duplicate (BSD):** The recoveries and RPD should fall within acceptance limits, or the samples associated with it may need to be redigested and reanalyzed. Use the following steps to determine if the sample results may be reported:

a. If the samples are being analyzed for only a subset of the target element list (ie: lead only, LUFT 5, etc.) and those elements all pass acceptance criteria, the data may be reported without further corrective action.

b. If a high recovery is observed but that element was not detected in the associated samples, note the failure on the Data Review Checklist and report the data without re-digestion, as the potential high bias does not affect the sample results.

c. If a high recovery is observed and the samples contain that element at levels above the reporting limits, the samples containing that element must be re-digested.

d. If a high RPD is observed but the recoveries are within acceptance limits and the samples do not contain that element, note the failure on the Data Review Checklist and report the data without re-digestion, as the lack of good precision data does not affect ND samples.

e. If a high RPD is observed and the samples contain that element at levels above the reporting limits, those samples containing that element must be re-extracted.

- **Matrix QC (SSPIKE/SDUP or MS/MSD):** The recoveries and RPD should fall within acceptance limits, or the samples associated with it may need to be redigested and reanalyzed. Use the following steps to determine any necessary corrective action:

  a. If the concentration of a target element in the sample is greater than the linear range and the sample needs to be rerun for just that compound, report the MS/MSD with a LIMS-flag of ">LR" on those recoveries, without reanalysis.

  b. If the concentration of a target element in the sample is within linear range but the concentration in the matrix spikes is greater than the linear range, LIMS will apply a ">LR" flag to those recoveries. Report the data without reanalysis.

  c. If the concentration of a target element is greater than 4x the spiking level, LIMS will apply a "NM" (for "Not Meaningful") flag to those recoveries. Report the data without reanalysis.

     Note: If the concentration of a target compound is greater than the spiking level, LIMS will flag and footnote that concentration for the client's attention.

  d. If recoveries fail but the RPD is within acceptance limits, matrix interference is usually suspected. Narrate the failure and report the data without reanalysis (except for USACE, or other Level 3 or Level 4 projects that always require reanalysis).

  e. If the recoveries are within limits but the RPD fails, and an isolated problem cannot be identified and documented, reanalyze the sample and matrix spikes.

- **Serial Dilutions:** Analysis of a 5x dilution should agree within 90-110% recovery (95-105% for EPA 200.7) of the original determination if the concentration of the element in diluted aliquot is greater than the reporting limit. If not a chemical or physical interference, such as viscosity of the digestate, should be suspected. If for a given project, all elements repeatedly show an increased response in the Serial Dilution, when compared to the initial run, discuss the problem with the Department Manager and/or the Project Manager for that account, as the samples may require routine dilution to overcome viscosity effects.

- **Post Digest Spikes:** An analyte spike added to a portion of a prepared sample digest, or its dilution, should be recovered to within 75-125% (80 – 120% for EPA 6010C or 90-110% for EPA 200.7) of the expected concentration. The spike addition should produce a minimum level of 10 times and a maximum level of 100 times the instrumental detection limit. If the recoveries of all elements show a uniform bias in either direction, make and analyze a new spike to verify that it was prepared correctly. If the spike is not recovered within the specified limits a matrix effect should be suspected and the sample should be diluted (to dilute out the matrix interference).

5.) Evaluate the Sample Results

Review any batch QC sample data first to verify that samples from that batch can be reported, then review the sample results to identify any samples that need to be rerun and/or diluted.

Examine the sample results to verify that all results are within the linear range. If the concentration of any requested target element is greater than the highest calibration standard for that element, use volumetric pipettes to prepare a dilution of the digestate so that the highest target element is in the upper half of the calibration range; see Appendix_2 for instructions. If a sample is analyzed at multiple dilutions, compare the sample results across the various dilutions to verify that the dilutions were prepared correctly. Do the results make sense or is there a discrepancy between the runs? If there seems to be a discrepancy, reanalyze the sample to confirm the results.

Examine the sample results to verify that the RSD between exposures is less than 20%. Any sample result with a duplicate exposure RSD greater than 20% must be reanalyzed. If the RSD is still greater than 20%, report the exposure with the lower %RSD. Any sample with requested element concentrations above the linear range must be diluted and reanalyzed.

6.) Reviewing and Reporting Results

1.) Open a web browser and go to the main METALS page.

2.) Under Recent Sequences, choose the instrument and then choose the sequence you want to review.

3.) Check the sequence for any errors. LIMS takes the run information directly from what is typed in the sequence. Typing errors can affect how the data is processed by LIMS.

If you need to make any changes to the sequence, click FIX. Make any needed changes and click UPDATE.

4.) Once everything is correctly processed in the sequence, review the sequence to see that all samples, STDs, and QC meet acceptance criteria. Samples and QC should have an "OK" flag in the QC column of the sequence, otherwise reanalysis may be required. Once the sequence has been reviewed, it must be signed in the REVIEW APP.

5.) Open REVIEW APP for the sequence by choosing the sequence (e.g. MET14 / 05/08/07) under the Review pull down list on the top right corner of the sequence page.

6.) Two windows should open. One window shows the main Review App page. One window shows the documents (e.g. reports, scanned documents, Form 1s, etc).

IMPORTANT! Make sure you are logged in with your own user initials. The current user's initials are displayed on the bottom left corner of the review app window. To logout, click the user initials and Review App will ask you to login.

7.) The sequence is listed on the left frame of the Review App page. Clicking on an item on that list will display the LIMS report and any associated documents.

8.) The analyst adds a comment that the sequence has been verified/reviewed for either all files in the sequence or those files the analyst has reviewed if the sequence is still running.

9.) From another open web browser go back to the main METALS page and click on run chooser.

10.) Enter the login number, analysis or rgroup (metals), and matrix for the job to be reported. Choose the result(s) to be reported for each sample and QC for the job.

11.) Select reports from the top left side of the screen. From the views section in the upper right select possible. This will list the possible reports that can be printed. Select the reports to be printed and print to nowhere. This will select and lock the final results in the LIMS database.

12.) From the REVIEW APP page you left open previously, enter the batch number in the box in front of the search button and click the button.

13.) Review the results and sign the main page of the batch.

14.) From a different open web browser, go back to the main METALS page and enter the job number you wish to report in the search box and select search. Open REVIEW APP for the job by choosing the job (e.g. 214373 METALS Filtrate) under the Review pull down list on the top right corner of the page.

15.) Review the results and sign the main page for the job.

16.) Inform the group leader that the job is ready for review.

17.) When the reviewer or group leader does the final review of the job, the level III or IV packages are generated at that time.

SAMPLE PREP DOCUMENTATION

A copy of the digestion benchbook page for the sample digestion must be scanned in under the batch number and included with the reported data. The digestion benchbook entries should include:

- C&T sample ID's and unique container identifier,
- date of sample digestion, initial volume or weight of sample, and final digestate volume,
- identity of QC samples (spikes, duplicates & LCS),
- amount of spikes added and LIMS identification numbers of all spiking solutions,
- a list of all reagents used (C&T ID or manufacturer and lot number),
- indication of whether or not the digests were filtered after digestion,
- any unusual occurrences observed during the digestion procedure

POLLUTION PREVENTION

Prepare only sufficient standard and reagent volume to use within the shelf-life of the standard to reduce the volume of waste generated by the laboratory.

WASTE DISPOSAL

All digests are kept for at least 6 months prior to disposal; after 6 months, the digests are included in the ‘Corrosives’ waste stream. Instrument waste is collected in a polyethylene carboy and discarded into the ‘Corrosives’ waste stream.

REVISION HISTORY

This is rev 11. Rev 10 was changed as follows:

- Text was added to integrate method 6010C and DoD QSM criteria and requirements.
- References were revised for appropriate revisions to methods and standards

APPENDIX_1: CALCULATIONS

Sample Concentration via Linear Regression with Internal Standard
Concentration (ug/L or ug/Kg) = (a0 + a1 * Ax)) * PDF * IDF

Where:
a0 = Y-intercept of regression equation
a1 = slope of regression equation
Ax = (IS-Corrected*) Intensity reading for the analyte in the sample, or (Sample Intensity / Internal Standard Intensity)
IDF = Instrument Dilution Factor
PDF = Prep Dilution Factor (Vf/Vi or Vf/Wi),
Where Vf = digestate final volume,
Vi = initial volume of liquid sample
Wi = initial weight of solid sample

Moisture Corrected Results
Dry Weight Concentration (ug/Kg) = "As Received" Conc. / ((100 - %moisture)/100)

BATCH QC CALCULATIONS

Percent Recovery (%R):
The recovery is the measured concentration divided by the true concentration of the spike.

%Recovery = (Cf – Cs) / (Cws * Vws/ S) *100

Where:
Cf = final measured concentration in the spiked sample
Cs = measured concentration in the un-spiked aliquot of sample
Cws = concentration of the spiking standard
Vws = volume used, of the spiking standard
S = Sample weight or volume

Relative Percent Difference (RPD):
The RPD is the absolute value of the difference in concentrations divided by the average of the concentrations.

%RPD = |(Cs - Cdup)| / ((Cs + Cdup)/2) * 100

Where:
Cs = measured sample concentration
Cdup = measured concentration in the duplicate

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For soil MS/MSD's where the sample weights are not weight-targetted, the expected concentrations will vary with sample weight (because the same volume of spike standard is being added to different weights of sample) and must be accounted for when calculating RPD:

$$\%RPD = |((Wms/Wmsd)*Cms - Cmsd)| / (((Wms/Wmsd) * Cms + Cmsd)/2) * 100$$

CALIBRATION EQUATIONS

Linear Regression Equations

$$y = mx + b$$

Where: y = response (Ax for external standard, or Ax/Ais for internal standard)
Where Ax = Area of compound
Ax / Ais = Area of compound divided by area of internal std
x = concentration (Cx for external standard, or Cx/Cis for internal standard)
m = slope
b = intercept

Slope (m) = $[(\sum wx_iy_i * \sum w) – (\sum wx_i * \sum wy_i)] / [(\sum w * \sum wx_i^2) – (\sum wx_i * \sum wx_i)]$

Intercept (b) = $y_{avg} – (m * x_{avg})$

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Correlation Coefficient (r)

$$r = \frac{[\,(\sum w * \sum wx_i y_i) - (\sum wx_i * \sum wy_i)\,]}{\sqrt{\{[\,(\sum w * \sum wx_i^2) - (\sum wx * \sum wx_i)] * [\,(\sum w * \sum wy_i^2) - (\sum wy_i * \sum wy_i)\,]\}}}$$

Coefficient of Determination (r^2) = r * r

Where: x_i = individual values for the independent variable (concentration)
y_i = individual values for the dependent variable (response, area)
w = weighting factor (for no weighting w = 1)
x_{avg} = average of the x-values
y_{avg} = average of the x-values

Make a Working Standard from a Source (Stock) Standard:
Determine the volume of source standard needed to make a given volume of working standard:

Vss (mL) = Vws * Cws / Css

Where: Vss = Volume of Source Standard (mL) needed to make Working Standard
Vws = Final Volume (mL) of Working Standard
Cws = Final Concentration (ug/mL) of the Working Standard
Css = Concentration (ug/mL) of the Source Standard

APPENDIX_2: SAMPLE DILUTIONS

If the sample concentration is greater than the highest point in the calibration curve, prepare a dilution at a level that will bring the absorbance into the middle of the calibration range. Examine the original sample data to determine what dilution factor will be required to bring the absorbance down to the middle of the calibration range.

Using calibrated auto-pipettes, dilute the following volumes of sample digestate in a disposable centrifuge tube; adjust the acid concentration to 5%. Cap and invert three times to mix, allowing sufficient time for complete mixing with each inversion.

DILUTIONS

Instrument Dilution Factor (IDF)	Digestate Volume	Add Volume (mL) Acidified DI Water	Final Volume (mL)
2	5.0 mL	5.0	10
5	2.0 mL	8.0	10
10	1.0 mL	9.0	10
20	0.50 mL	9.5	10
50	0.20 mL	9.8	10
100	0.10 mL	9.9	10

If a sample should need a dilution of more than 100x, prepare a 100x dilution first, then use that to make subsequent dilutions.

SERIAL DILUTIONS

Instrument Dilution Factor	Using Primary Dilution	Volume of Primary (100x) Dilution	Add Volume (mL) Acidified DI Water	Final Volume (mL)
500	100x	2.0 mL	8.0	10
1,000	100x	1.0 mL	9.0	10
2,000	100x	0.5 mL	9.5	10
5,000	100x	0.2 mL	9.8	10
10,000	100x	0.1 mL	9.9	10

APPENDIX_3: REAGENTS & STANDARDS

REAGENTS

The preparation of all liquid or solid reagents, including dilutions into DI water, must be documented in the reagent prep benchbook. Each reagent is assigned a unique ID, based on the manufacturer and the date prepared. This ID is then recorded in the digestion benchbook each time the reagent is used.

Label each reagent with the reagent ID, concentration, prep date, and expiration date. All reagents should be prepared and stored in freshly cleaned glassware. Expired, discolored, or contaminated reagents should be discarded and the bottle cleaned before reuse.

Argon, Purity: 99.99%
Air, C&T house compressed air

Deionized water, ASTM Type II (ASTM D1193)

Aqua Regia: *prepare daily*
Prepare immediately before use in a glass bottle by adding 3 volumes of concentrated HCl to one volume HNO_3, typically preparing about 125mL aqua regia per batch (32mL HCl + 96mL HNO_3 => 128mL total). Aqua Regia must be prepared daily.

Nitric Acid (HNO_3), concentrated, InstraAnalyzed grade
JT Baker catalog # 7697-37-2
Store unopened bottles in the corrosives cabinet and open bottles under the fume hood for up to ten years.

Hydrochloric Acid (HCl), concentrated, InstraAnalyzed grade
JT Baker catalog # 7647-01-0
Store unopened bottles in the corrosives cabinet and open bottles under the fume hood for up to ten years.

STANDARDS

All source standards must be documented in LIMS upon receipt, through the Standards Menu". The LIMS S-name is unique to the vendor that the source is obtained from; if a source standard is obtained from a different vendor, a new S-name must be assigned and the information entered in the "Standard Entry" table before the standard can be assigned a unique S# (standard number).

The LIMS Standard Maintenance database includes the catalog#, lot#, expiration date, and concentration of the standards as they are received from the vendor. Write the S# and the date received on both the standard vial and on the 'Certificate of Analysis' that accompanied the standard. If the supplier did not provide a certificate, call and request that a copy be faxed. The Certificate of Analysis must be kept on file in the appropriate binder.

Prepare working standards by diluting source standards to volume in a Class-A volumetric flask. Document the preparation in the standards benchbook. Enter the prep information into LIMS through the "Standard Maintenance" menu; LIMS will then assign a unique S# to that standard. Write the LIMS S# and expiration date in the benchbook along with the prep information. Label the standard vial with the contents, the LIMS S#, the expiration date of the standard, and the prep chemist's initials.

Store standards at room temperature, away from light (to prevent photo-induced precipitation of silver). If the Certificate of Analysis or bottle label did not include an expiration date, assign an expiration date of one year from the date received.

Note: Prepare calibration Blanks (ICB/CCB) by adding 5.0 mL concentrated HNO_3 and 5.0 mL concentrated HCl to DI water and diluting to 100 mL.

~1 mg/L Manganese standard, used to verify lamp alignment
Dilute approximately 10µL of 10,000 mg/L Manganese standard (CPI# S4400-10M321) to 100mL in acidified (5% HCl, 5% HNO_3) deionized water. Store at room temperature for up to 1 year.

30ppm Yttrium, Internal Standard Solution
Dilute 3.0 mL of 10,000 mg/L Yttrium (Inorganic Ventures # CGY10-5) into 1L of acidified (5% HNO3, 5% HCl) deionized water. Store at room temperature for up to one year. *Note:* Because the instrument is calibrated daily, the Yttrium source standard may be used past the manufacturer's expiration date, so long as the entire sequence is analyzed using the same, freshly prepared, internal standard solution.

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Calibration Standards for the 4300DV ICP (MET-08)

	Element	CRI08 (mg/L)	CS100 (mg/L)	CS1K (mg/L)	CS10K (mg/L)	CS100K (mg/L)	Axial or Radial
Sb	Antimony	0.005	0.100	1.00	10.0	- -	A
As	Arsenic	0.005	0.100	1.00	10.0	- -	A
Ba	Barium	0.010	0.100	1.00	10.0	- -	A
Be	Beryllium	0.002	0.100	1.00	- -	- -	A
Cd	Cadmium	0.005	0.100	1.00	10.0	- -	A
Cr	Chromium	0.005	0.100	1.00	10.0	- -	A
Co	Cobalt	0.005	0.100	1.00	10.0	- -	A
Cu	Copper	0.005	0.100	1.00	10.0	- -	A
Pb	Lead	0.003	0.100	1.00	10.0	- -	A
Mo	Molybdenum	0.005	0.100	1.00	10.0	- -	A
Ni	Nickel	0.005	0.100	1.00	10.0	- -	A
Se	Selenium	0.005	0.100	1.00	10.0	- -	A
Ag	Silver	0.005	0.100	1.00	2.0	- -	A
Tl	Thallium	0.005	0.100	1.00	10.0	- -	A
V	Vanadium	0.005	0.100	1.00	10.0	- -	A
Zn	Zinc	0.005	0.100	1.00	10.0	- -	A
Al	Aluminum	0.100	- -	1.00	10.0	100.	R
Ca	Calcium	0.200	- -	1.00	10.0	100.	R
Fe	Iron	0.100	- -	1.00	10.0	100.	R
Mg	Magnesium	0.200	- -	1.00	10.0	100.	R
Mn	Manganese	0.005	0.100	1.00	10.0	- -	R
K	Potassium	0.500	- -	1.00	10.0	100.	R
Na	Sodium	0.500	- -	1.00	10.0	100.	R
B	Boron	0.100	- -	1.00	10.0	- -	A
Sn	Tin	0.040	0.100	1.00	10.0	- -	A
Ti	Titanium	0.010	0.100	1.00	10.0	- -	A

Calibration Verification and Interference Check Standards Solutions for MET-08

Element	ICV VERT (mg/L)	CCV VERT (mg/L)	ICSA08 (mg/L)	ICSAB-T (mg/L)
Ag	5.0	5.0	- -	1.0
As	5.0	5.0	- -	0.5
Al	20.	20.	500	500
B	5.0	5.0	- -	- -
Ba	5.0	5.0	- -	0.5
Be	5.0	5.0	- -	0.5
Ca	20.	20.	500	500
Cd	5.0	5.0	- -	1.0
Co	5.0	5.0	- -	0.5
Cr	5.0	5.0	20	0.5
Cu	5.0	5.0	20	0.5
Fe	20.	20.	200	200
K	20.	20.	- -	- -
Mg	20.	20.	500	500
Mn	5.0	5.0	20	0.5
Mo	5.0	5.0	- -	0.5
Na	20.	20.	- -	- -
Ni	5.0	5.0	20	1.0
Pb	5.0	5.0	- -	1.0
Sb	5.0	5.0	- -	0.5
Se	5.0	5.0	- -	0.5
Sn	5.0	5.0	- -	- -
Ti	5.0	5.0	20	20
Tl	5.0	5.0	- -	0.5
V	5.0	5.0	20	0.5
Zn	5.0	5.0	- -	1.0

APPENDIX_4: TARGET ELEMENTS & STANDARD REPORTING LIMITS

	Element	Water Reporting Limit (ug/L)	Soil Reporting Limit (mg/Kg)
Sb	Antimony	10.	0.50
As	Arsenic	5.0	0.25
Ba	Barium	5.0	0.25
Be	Beryllium	2.0	0.10
Cd	Cadmium	5.0	0.25
Cr	Chromium	5.0	0.25
Co	Cobalt	5.0	0.25
Cu	Copper	5.0	0.25
Pb	Lead	3.0	0.15
Mo	Molybdenum	5.0	0.25
Ni	Nickel	5.0	0.25
Se	Selenium	10.	0.50
Ag	Silver	5.0	0.25
Tl	Thallium	10.	0.50
V	Vanadium	5.0	0.25
Zn	Zinc	20.	1.0
Al	Aluminum	100	5.0
Ca	Calcium	500	25
Fe	Iron	100	5.0
Mg	Magnesium	500	25
Mn	Manganese	5.0	0.25
K	Potassium	500	25
Na	Sodium	500	25
B	Boron	100	5.0
P	Phosphorous	100	5.0
Si	Silicon	200	10.
Sn	Tin	40.	2.0
Ti	Titanium	10.	0.50

APPENDIX_5: SPIKING LEVELS (BS, BSD, MS, MSD & SSPIKE)

Blank spike/ blank spike duplicates and sample spikes (or matrix spike/ matrix spike duplicates) should be spiked at the following levels:

	Element	Water Spiking Level (ug/L)	Soil Spiking Level (mg/Kg)
Sb	Antimony	500	25
As	Arsenic	100	5.0
Ba	Barium	2,000	100
Be	Beryllium	50	2.5
Cd	Cadmium	50	2.5.
Cr	Chromium	200	10
Co	Cobalt	500	25
Cu	Copper	250	12.5
Pb	Lead	100	5.0
Mo	Molybdenum	400	20
Ni	Nickel	500	25
Se	Selenium	100	5.0
Ag	Silver	50	2.5
Tl	Thallium	100	5.0
V	Vanadium	500	25
Zn	Zinc	500	25
Al	Aluminum	2,000	100
Ca	Calcium	20,000	1,000
Fe	Iron	1,000	50
Mg	Magnesium	20,000	1,000
Mn	Manganese	50	2.5
K	Potassium	10,000	500
Na	Sodium	20,000	1,000

APPENDIX_6: INSTRUMENT OPERATING CONDITIONS

AXIAL / RADIAL ICP (Perkin Elmer Model 5300 DV)

Argon	Purity	99.99%
	Max Pressure	60 psi
	Min Pressure	25 psi *
Flow Rates	Plasma	17 L/min
	Auxiliary	0.4 L/min
	Nebulizer	0.55 L/min
Peristaltic Pump	Rate	1.75 mL/min
Nebulizer	Concentric Glass	Meinhard, Type A
Injector	Alumina	2.0mm
Torch	Type	Quartz
Rf Power		1450 Watts
Water Cooler	Temperature	20°C
	Pressure	30 – 60 psi
	Flow Rate	400 mL/min

**Note:* Call South Bay Welding to order an Argon delivery when the outside tank pressure is around 25-30 inches.

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APPENDIX_7: EQUIPMENT & MAINTENANCE

For Perkin-Elmer 5300DV ICP-AES Instruments

Any maintenance performed on the instrument must be documented in the instrument maintenance logbook. Whenever preventative or trouble-shooting maintenance is performed, document 1.) the reason the maintenance was necessary, 2.) the action taken, and 3.) the resolution of the maintenance ("passed CRI", "RSD's OK", etc.).

Perkin-Elmer's online catalog (Optima 4X00 DV heading) can be accessed at their website: http://las.perkinelmer.com/catalog/Category.aspx?CategoryName=ICP+Optical+Emission+Spectrometry+Consumables+for+Instruments or by phone at (800)-762-4000.

Tubing & Pump Windings should be replaced frequently, whenever air bubbles are present in the tubing or, for the internal standard tubing, the internal standard readings become unstable. The type of tubing can be identified by the color-coded tags at each end of the piece. Order replacement tubing from Perkin-Elmer or CPI and keep at least one spare set on-hand.

Internal Standard	Orange-Red, 0.19mm ID	P/E # N0695476
Sample Tubing	Black-Black, 2 stop	CPI # 4062-430
Drain Tubing	Red-Red, 2 stop	CPI # 4062-445

The **torch** and **injector** should be changed and cleaned whenever the torch alignment intensity drops by 20%. Immerse the parts in aqua regia over night, at minimum. Replacements can be ordered from Perkin-Elmer or CPI.

Torch:	P/E # N0770338
Copper Foil:	P/E # N0775297
Injector (2.0 mm):	P/E # N0582184

If the **nebulizer** becomes plugged, see the Operator Manual for detailed instructions.

Nebulizer (Type A):	P/E # 00472020

Lubricate the autosampler tracks approximately every six months by wiping the tracks with a Kim-Wipe saturated with 1-in-3 or clear oil.

APPENDIX_8: USING THE WINLAB-32 SOFTWARE

Start from Overnight Standby Mode:

1.) Fill the autosampler rinsate bottle with acidified (2% HNO3, 2% HCl) DI water.
2.) Replace the pump tubing in the channel around the top of the pump then close the platen (clamp), making sure the tubing is not twisted and is centered in the clamp.
3.) Place the end of the sample uptake ("sipper") tube into a fresh aliquot of DI water.
4.) Place the end of the internal standard uptake tube into a fresh aliquot of internal standard solution.
5.) Turn on the peristaltic pump so that it rotates <u>counterclockwise</u>.
6.) On the computer monitor, maximize the WinLab32 window.
7.) From the main menu, select the 'File' pull-down menu, then Open, Open_Method, and click on the most recent instrument method (ex: 6010IS).
8.) Click the PLASMA icon to open the Plasma Control screen.
9.) Click ON to turn on the Plasma and automatically adjust the instrument settings to the parameters that are specified in the selected method.
10.) Allow the instrument approximately 1 hour to equilibrate.

"Profile" the Spectrometer

After the instrument has equilibrated, follow these steps to optimize the optics settings before calibration or analysis:

1.) From the main menu, select the 'Tools' pull-down menu, then Spectrometer_Control.
2.) Click 'Hg Realign' to check the axial alignment of the mercury lamp, across the diameter of the lamp.
3.) Place the sipper tube in the 1 mg/L Manganese solution.
4.) On the Spectrometer_Control window, click 'Align View'.
5.) Open the Spectra_Display to verify that the Manganese signal is getting to the detector.
6.) Verify that the 'Select Analyte' box reads [Mn 257.610]. *Note:* Manganese is used because it is a mid-range wavelength.
7.) Click ON. Instrument will then scan the response across the lamp.
8.) Check the 'Results' page to verify that lamp is properly aligned and the x-position for the maximum response is at or near 0.00.
9.) On the Spectrometer_Control window, change the Manual Settings from Axial to Radial.
10.) Click 'Align View'.
11.) Click 'ON'.
12.) From the main menu, select File, Print, Active_Window.
13.) Close 'Results'.
14.) Close 'Spectrometer Control'.
15.) Write the positions & intensities in the instrument maintenance log.
16.) Move the sipper tube to the rinse DI and allow the system to rinse for about 1 minute while you start writing the sequence.

Set Up a Sequence

1.) In the online session, open METHOD_EDITOR.

a.) Open the method you want to use.
b.) Verify that the LIMS S# is correct for each standard.
c.) Close the Method Editor.

2.) Click the SamInfo icon and enter the sample information under the 'Parameters that Vary by Sample' heading.
   a.) For samples (or batch QC), the first A/S Location will be 11, because spots 1 through 10 are always used for the standards.
   b.) The standards are not entered into the sequence because the identities and frequencies are specified in the software method.
   c.) In the 'Sample ID' column, enter sample information in the format:
      Sample #, batch#, IDF
      MB, QC#, batch#, IDF
      LCS, QC#, batch#, IDF
      Etc…
         Where:
         Samplenum is the LIMS sample number (ie: 160961-005)
         QC# is the LIMS ID of the batch QC sample (ie: QC16935)
         Batch# is the LIMS batch number (ie: 95687)
         IDF is the instrument dilution factor for the sample, written as "5" or similar
   d.) To insert instrument blanks (rinses), set the A/S Location to '0' (zero) and the sample ID to 'rinse' or IB.
   e.) When your sequence is complete, pull-down the File menu, and select Save_As, Sample Info File, and name the file with the day's date (ex: 092404.sif).
      Important! Make sure to save the Sample Info File as an SIF, *not* as the method!
   f.) From the File pull-down menu, select Print, Active_Window to print the sequence.
   g.) Close the Sample Info File window.

3.) Load the autosampler.
4.) Verify the sample locations in the autosampler tray against the sequence.
5.) Start the sequence.
   a.) From the main menu, click the AUTO icon (to use the autosampler locations).
   b.) In the SetUp sheet, call up the most recent Sample Info File.
   c.) "Results Data Set Name".
   d.) Type in the date as MMDDYY (ex: 092404).
   e.) Make sure the following are checked for use:
      Use Sample Info — Save Data
      Print Log during analysis — <don't check "Auto export">
      Auto Wavelength Realign (every 60 seconds)
   f.) Verify that the correct method and sample info file have been called up.
   g.) Choose which type of run you need to start:
      CALIBRATE - will only run the beginning calibration standards
      ANALYZE ALL - will run the whole sequence
      ANALYZE SAMPLES - runs only the samples after the ICAL standards
   h.) Click OK.

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6.) Leave the window open so you can verify the status of the sequence as it is running. This window can be minimized if you are working in another window, but don't close it or the instrument will immediately stop running the sequence!

Send Data to LIMS

1.) Click the DATA MANAGER icon on the desktop.
2.) Enter the current sequence name into the 'Result Name' field.
3.) Click the EXPORT button at the top of the screen.
4.) Select 'Create', then 'Browse'.
5.) Find the LIMS.xpt file and 'Open' the file.
6.) Click the FINISH button at the bottom of the screen.
7.) Then EXPORT and FINISH sending the data to LIMS.

Edit a Sequence

If you need to add samples to the sequence, you must stop the instrument run and edit the sequence through the SamInfo screen, *then* go to the 'Analyze' sheet and 'Rebuild List'. Print the active window to print the modified sequence.

Use the Priority button on the 'Analyze' sheet to do immediate reanalysis of the sample. The software will automatically reposition the CCV & CCB, as the methods specify the frequency of their analysis.

Reprocess Data

Use the offline session to reprocess old data files, when needed.

1.) Maximize the 'WinLab32 Offline' window.
2.) Verify that the method named in the upper right corner, next to the "Method' label, is the method that you want to use. If not, open the correct method.
3.) Click REPROC.
4.) Select the Data Set to be reprocessed and save it with an '-R' suffix.

View/Print Uncorrected Intensities

If a client, validator or auditor asks for the original, uncorrected (for internal standard) intensities, use the following steps to view or print those readings:

1.) Maximize the 'WinLab32 Offline' window.
2.) Select the sequence you need to reprocess.
3.) Verify that the method named in the upper right corner, next to the "Method' label, is the method that you want to use. If not, open the correct method.
4.) Go to the menu bar and select Process > Internal Standard.
5.) Remove the IS assignment from each element. *Caution:* Don't save this version unless you save it with a different method name, or else it will overwrite the original data when you reprocess it and you will have to go back and redo it again.
6.) Go to the sequence and highlight the calibration and data files you want to reprocess.
7.) Click REPROC to reprocess those files and either view the readings onscreen or send them to a local printer.

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APPENDIX_9: DATA MANAGEMENT

All of the following database functions are accessed from within the Database Manager Utility. Both the online and offline versions of Optima WinLab32 should be closed while performing these functions.

1. **Check the Library** (should be done weekly)
   a. Open the **Data Manager Utility.**
   b. Click on the **Check** button to run a check of the **Results** database.
   c. Change the Library Category from Results to **Methods.**
   d. Click on the **Check** button to run a check of the Methods database.

2. **Archive Files in the Results Library** (should be done bimonthly, in the second week of the month following the two month period to be archived. For example, March and April should be archived in the week of May 15th.)
   a. Change **back to the Results library** if needed.
   b. Selecting one month's worth at a time, **highlight the files you want to archive**. You can either click and shift click to highlight all files in between the two selected files, or click and Ctrl click to select individual files.
   c. **Select the Archive box.** Select OK.
   d. The files that are to be archived will appear in the window. Use the **browse button** to **select the location** for the **archived file**. Use the defaults location (C:\pe\Curtis and Tompkins\Archived Data\).
   e. The archive name is automatically selected. The file name will start with MS for a methods archive, and RS for a results archive. The rest of the file name will be the six characters representing the date the archive was created. **<u>CHANGE</u> THE DATE TO REPRESENT THE DATE OF THE FILES ARCHIVED IN THE FORMAT RSMMYYYY.ZIP.**
   f. Select OK and the archive will be created.
   g. Repeat a –f above, changing the location for the archived file to G:\met08\.

3. **Deleting Archived Files From the Results Database**
   h. After the month's archives have been created on both the C: drive and on the G: drive, **highlight the files** you want deleted.
   i. Click on the **delete box**.
   j. The selected files that are to be deleted will be listed. Make sure you are deleting the correct files!
   k. Select OK, the files are now deleted.

4. **Packing The Results Library** (should be done after deleting files from the Database)
   l. **Click** on the **Pack button.**

APPENDIX_10: INTERFERENCES

Matrix interferences may cause inaccuracies in the determined element concentrations. These interferences generally fall into three categories: spectral interferences, chemical interferences, and physical interferences.

Spectral interferences may include:

1.) The overlap of the spectral line of one element with another, which can be minimized through use of interelement correction (IEC) factors. The IEC factors are determined annually. High levels of aluminum, calcium, iron, and magnesium are often responsible for this type of interference. The daily ICSAB standard is used verify the correction factors for contributions from high levels of these elements.
2.) Unresolved overlap of molecular spectra, which may require selection of an alternate wavelength for measurement or dilution and reanalysis of the sample.
3.) Background contributions from continuous or recombination phenomena, or from the emissions of elements present at high concentrations. Background correction can compensate for these effects by measuring the emissions adjacent to the analyte line.

Chemical interferences are characterized by molecular compound formation, ionization effects, and vaporization effects. These types of interferences are highly matrix dependent and are not often seen in the ICP analysis, since the plasma will dissociate most compounds.

Physical interferences are typically those occurring during the digestion, nebulization, and transport. Common physical interferences include:

1.) Loss of volatile elements (antimony) during the digestion process if the digestate is superheated or allowed to go dry during heating.
2.) Precipitation of certain elements (silver) during the digestion process if present in relatively high levels.
3.) Zinc contamination due to dusty surroundings.
4.) Differences in sample viscosity and surface tension due to high levels of dissolved solids. Serial dilutions may be used to identify this type of interference, which may clog the nebulizer and tubing.

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APPENDIX_11: **EPA 200.7**
Metals in Drinking Water & Wastewater

The following criteria and discussion apply to any samples submitted for the EPA 200.7 analysis:

INITIAL CALIBRATION:
Method 200.7 only requires a single-point calibration and does not specify a correlation coefficient (r) criteria but C&T analyzes a multi-point calibration with an acceptance criterion of r $\geq$0.995. The same general calibration criteria must be followed as for 6010 (ie: intermediate levels may not be dropped, the low point must be at or below the reporting limit, etc.).

CALIBRATION VERIFICATION (ICV/CCV):
Method 200.7 requires that ICV and CCV concentrations be obtained by using the average of replicate exposures, with an RSD of $\leq$ 3% between exposures. The ICV and CCV recoveries must be within 5% of the true concentration (95-105% recovery).

INTERFERENCE CHECK STANDARDS (ICS-A and ICS-AB):
ICS-AB standards containing both common interferents and low-level target analytes should be analyzed at the beginning of each sequence, after the calibration standards and verifications, and at the end of the sequence. The recovery for each analyte should be within 80-120% of the true concentration or the associated sample results for that element may not be reported.

EPA 200.7 does not mention the ICS-A standard; C&T standard practice is to include this standard in the analytical sequence, following SW-846 guidance as described in the main body of this SOP. The determined concentration of the non-interferent should be no more than $\pm$RL in either direction.

SAMPLE ANALYSIS:
EPA 200.7 requires that the samples be aspirated for at least 30 seconds prior to collection of data to allow the response to stabilize; C&T aspirates the samples for approximately 30 seconds or longer when necessary, as described in the main body of this document.

EPA 200.7 requires a minimum of 3 integrations for each mass, reporting the average of the three; this matches C&T standard practice as described in the main body of this SOP. The method does not discuss a limit on the RSD between these integrations; C&T has established an internal requirement of 20%RSD between the integrations. If the RSD is >20, the sample must be rerun and/or diluted to reduce matrix interferences.

BATCH QC:
- Method Blank: EPA 200.7 requires redigestion and reanalysis of any sample associated with a method blank containing laboratory contamination greater than **2.2x the MDL** for that element and <10x the concentration in the sample. If the sample is ND for the blank

contaminant or is >10x the level found in the blank, the sample may be reported without corrective action.

- BS/BSD: EPA 200.7 specifies LCS (or LFB, "Lab Fortified Blank") recovery limits of **85-115%** but does not discuss the use of a duplicate. C&T digests and analyzes a pair of blank spikes with every batch to better monitor both the accuracy and precision of the process; RPD limits are based on statistically generated control limits.

- MS/MSD: EPA 200.7 specifies recovery limits of **70-130%** but does not discuss the use of a duplicate. C&T digests and analyzes a pair of matrix spikes with every batch to better monitor both the accuracy and precision of the process on real-world samples; RPD limits are based on statistically generated control limits.

- Serial Dilution recovery limits are 95-105%.

- Post Digestion Spike recovery limits are 90-110%

INITIAL DEMONSTRATION OF CAPABILITY
Each new analyst must complete an "IDOC" consisting of 4 consecutive LCS/BS/BSD batch QC samples that pass recovery and RPD/RSD limits. For EPA 200.7, the IDOC also includes analysis of an MDL study.

INSTRUMENT DETECTION LIMIT (IDL) STUDY
IDL studies must be completed quarterly by analyzing a reagent blank for seven consecutive injections on each of 3 non-consecutive days. The RSD is determined for each element on each day then the 3 RSD's are averaged to determine the IDL.

Intentionally Left Blank

EPA 6010B Soil Method List

List # : 72139 Account : METHOD_LIST Effective : 11-NOV-2009 Generated : 12/30/09 12:25
Method : EPA 6010B Units : mg/Kg J Flagging : N

Analyte	RL	BS %REC	BSD	MS %REC	MSD	Flags
Aluminum	5	58-126	23	1-190	61	
Antimony	0.5	75-122	19	1-142	47	
Arsenic	0.25	76-119	20	45-136	39	
Barium	0.25	73-120	18	11-172	49	
Beryllium	0.1	80-122	19	56-133	32	
Cadmium	0.25	77-120	18	46-132	29	
Calcium	25	66-126	22	7-178	43	
Chromium	0.25	74-118	25	27-153	40	
Cobalt	0.25	72-114	18	34-139	42	
Copper	0.25	72-117	17	12-174	49	
Iron	5	71-123	20	18-166	57	
Lead	0.25	73-117	24	27-147	54	
Magnesium	25	68-124	24	1-184	45	
Manganese	0.25	78-117	18	22-169	43	
Molybdenum	0.25	79-120	20	43-130	33	
Nickel	0.25	73-115	17	15-165	46	
Potassium	25	66-116	20	15-167	34	
Selenium	0.5	71-121	19	44-132	30	
Silver	0.25	72-115	17	47-130	29	
Sodium	25	67-122	19	31-153	42	
Thallium	0.5	73-116	18	40-124	28	
Vanadium	0.25	72-121	18	18-167	39	
Zinc	1	71-119	18	6-172	53	
Boron	5	64-124	16	23-140	42	
Phosphorus	5	80-120	20	70-130	30	
Silicon	10	80-120	20	70-130	30	
Sulfide	5	80-120	20	70-130	30	
Strontium	2	80-120	20	70-130	51	
Tin	2	68-128	19	38-132	43	
Titanium	0.5	77-120	17	1-194	47	

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MDL Summary for EPA 6010B Soil
As of 12/01/09

Analyte	Units	MET08 A	MET08 R	MET09 A	MET09 R	Highest
Aluminum	mg/Kg		1.3		1.3	1.3
Antimony	mg/Kg	0.16		0.15		0.16
Arsenic	mg/Kg	0.083		0.073		0.083
Barium	mg/Kg	0.10		0.10		0.10
Beryllium	mg/Kg	0.020		0.020		0.020
Cadmium	mg/Kg	0.050		0.050		0.050
Calcium	mg/Kg		5.0		5.8	5.8
Chromium	mg/Kg	0.10		0.10		0.10
Cobalt	mg/Kg	0.20		0.20		0.20
Copper	mg/Kg	0.10		0.10		0.10
Iron	mg/Kg		1.6		1.6	1.6
Lead	mg/Kg	0.073		0.070		0.073
Magnesium	mg/Kg		5.0		5.0	5.0
Manganese	mg/Kg	0.10		0.10		0.10
Molybdenum	mg/Kg	0.20		0.20		0.20
Nickel	mg/Kg	0.20		0.20		0.20
Potassium	mg/Kg		6.3		5.5	6.3
Selenium	mg/Kg	0.15		0.16		0.16
Silver	mg/Kg	0.075		0.050		0.075
Sodium	mg/Kg		5.0		5.0	5.0
Thallium	mg/Kg	0.16		0.14		0.16
Vanadium	mg/Kg	0.10		0.10		0.10
Zinc	mg/Kg	0.20		0.20		0.20
Boron	mg/Kg	1.0		1.0		1.0
Strontium	mg/Kg		1.0		0.69	1.0
Tin	mg/Kg	0.40		0.40		0.40
Titanium	mg/Kg		0.13		0.13	0.13

METALS
STANDARD REPORTING LIMITS

Curtis & Tompkins, Ltd.

CA Title-22 Metals (CAM-17)
EPA 6010B/7400

CAS #		Element	Reporting Limit µg/L	mg/Kg
7440-36-0	Sb	Antimony	10	0.5
7440-38-2	As	Arsenic	5	0.25
7440-39-3	Ba	Barium	5	0.25
7440-41-7	Be	Beryllium	2	0.1
7440-43-9	Cd	Cadmium	5	0.25
7440-47-3	Cr	Chromium	5	0.25
7440-48-4	Co	Cobalt	5	0.25
7440-50-8	Cu	Copper	5	0.25
7439-92-1	Pb	Lead	3	0.25
7439-97-6	Hg	Mercury	0.2	0.02
7439-98-7	Mo	Molybdenum	5	0.25
7440-02-0	Ni	Nickel	5	0.25
7782-49-2	Se	Selenium	10	0.5
7440-22-4	Ag	Silver	5	0.25
7440-28-0	Tl	Thallium	10	0.5
7440-62-2	V	Vanadium	5	0.25
7440-66-6	Zn	Zinc	20	1

Cations
EPA 6010B

CAS #		Element	Reporting Limit µg/L	mg/Kg
7429-90-5	Al	Aluminum	100	5
7440-70-2	Ca	Calcium	500	25
7439-89-6	Fe	Iron	100	5
7439-95-4	Mg	Magnesium	500	25
7439-96-5	Mn	Manganese	5	0.25
7440-09-7	K	Potassium	500	25
7440-23-5	Na	Sodium	500	25

Miscellaneous Metals
EPA 6010B

CAS #		Element	Reporting Limit µg/L	mg/Kg
7440-42-8	B	Boron	100	5
7723-14-0	P	Phosphorous	100	5
7440-21-3	Si	Silicon	200	10
7440-31-5	Sn	Tin	40	2
7440-32-6	Ti	Titanium	10	0.5

Priority Pollutant Metals (PP-13)
EPA 6010B/7400

CAS #		Element	Reporting Limit µg/L	mg/Kg
7440-36-0	Sb	Antimony	10	0.5
7440-38-2	As	Arsenic	5	0.25
7440-41-7	Be	Beryllium	2	0.1
7440-43-9	Cd	Cadmium	5	0.25
7440-47-3	Cr	Chromium	5	0.25
7440-50-8	Cu	Copper	5	0.25
7439-92-1	Pb	Lead	3	0.25
7439-97-6	Hg	Mercury	0.2	0.02
7440-02-0	Ni	Nickel	5	0.25
7782-49-2	Se	Selenium	10	0.5
7440-22-4	Ag	Silver	5	0.25
7440-28-0	Tl	Thallium	10	0.5
7440-66-6	Zn	Zinc	20	1

Mercury
EPA 7470A / EPA 7471A

CAS #		Element	Reporting Limit µg/L	mg/Kg
7439-97-6	Hg	Mercury	0.2	0.02

RCRA-8 Metals
EPA 6010B/7400

CAS #		Element	Reporting Limit µg/L	mg/Kg
7440-38-2	As	Arsenic	5	0.25
7440-39-3	Ba	Barium	5	0.25
7440-43-9	Cd	Cadmium	5	0.25
7440-47-3	Cr	Chromium	5	0.25
7439-92-1	Pb	Lead	3	0.25
7439-97-6	Hg	Mercury	0.2	0.02
7782-49-2	Se	Selenium	10	0.5
7440-22-4	Ag	Silver	5	0.25

CA LUFT-5 Metals
EPA 6010B

CAS #		Element	Reporting Limit µg/L	mg/Kg
7440-43-9	Cd	Cadmium	5	0.25
7440-47-3	Cr	Chromium	5	0.25
7439-92-1	Pb	Lead	3	0.25
7440-02-0	Ni	Nickel	5	0.25
7440-66-6	Zn	Zinc	20	1

ICP-MS Metals
EPA 6020

CAS #		Element	Reporting Limit*		CAS #		Element	Reporting Limit*	
			µg/L	mg/Kg				µg/L	mg/Kg
7429-90-5	Al	Aluminum	50	1	7439-95-4	Mg	Magnesium	50	25
7440-36-0	Sb	Antimony	1	0.25	7439-96-5	Mn	Manganese	1	0.25
7440-38-2	As	Arsenic	1	0.25	7439-98-7	Mo	Molybdenum	1	0.25
7440-39-3	Ba	Barium	1	0.25	7440-02-0	Ni	Nickel	1	0.25
7440-41-7	Be	Beryllium	1	0.25	7440-09-7	K	Potassium	50	25
7440-43-9	Cd	Cadmium	1	0.25	7782-49-2	Se	Selenium	1	0.25
7440-70-2	Ca	Calcium	50	25	7440-22-4	Ag	Silver	1	0.25
7440-47-3	Cr	Chromium	1	0.25	7440-23-5	Na	Sodium	50	25
7440-48-4	Co	Cobalt	1	0.25	7440-28-0	Tl	Thallium	1	0.25
7440-50-8	Cu	Copper	1	0.25	7440-62-2	V	Vanadium	1	0.25
7439-89-6	Fe	Iron	50	1	7440-66-6	Zn	Zinc	5	1.0
7439-92-1	Pb	Lead	1	0.25					

Low Level ICP-MS Metals
EPA 6020 (by special request)

CAS #		Element	Reporting Limit*		CAS #		Element	Reporting Limit*	
			µg/L	mg/Kg				µg/L	mg/Kg
7429-90-5	Al	Aluminum	50	1	7439-95-4	Mg	Magnesium	50	25
7440-36-0	Sb	Antimony	0.25	0.25	7439-96-5	Mn	Manganese	0.25	0.25
7440-38-2	As	Arsenic	0.5	0.25	7439-98-7	Mo	Molybdenum	0.5	0.25
7440-39-3	Ba	Barium	0.25	0.25	7440-02-0	Ni	Nickel	0.25	0.25
7440-41-7	Be	Beryllium	0.25	0.25	7440-09-7	K	Potassium	50	25
7440-43-9	Cd	Cadmium	0.25	0.25	7782-49-2	Se	Selenium	0.5	0.25
7440-70-2	Ca	Calcium	50	25	7440-22-4	Ag	Silver	0.25	0.25
7440-47-3	Cr	Chromium	0.5	0.25	7440-23-5	Na	Sodium	50	25
7440-48-4	Co	Cobalt	0.25	0.25	7440-28-0	Tl	Thallium	0.5	0.25
7440-50-8	Cu	Copper	0.5	0.25	7440-62-2	V	Vanadium	1	0.25
7439-89-6	Fe	Iron	50	1	7440-66-6	Zn	Zinc	5	1.0
7439-92-1	Pb	Lead	0.25	0.25					

Note: Lower reporting limits may be possible for some elements. Contact your laboratory Project Manager for details.

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MOISTURE (% Solids)

In SOILS & SEDIMENT

US-EPA CLP Method ILM04.0

Approved:

Inorganics Group Leader/ Date	QA Director/ Date

Read & Understood:

Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date

Re-Approved:

Inorganics Group Leader/ Date	QA Director/ Date

MOISTURE (% Solids) IN SOILS & SEDIMENT
CLP Method ILM04.0

SCOPE
Percent solids is defined as the residue left after drying a 5-10 gram aliquot of the sample at 103-105 °C. Samples are weighed to the nearest 0.0001 g so that variations in moisture can be detected to 0.1% level or better and sample results for other analyses can be "dry-weight" corrected.

The results from this analysis are used to "correct" the results from other analyses so that those results can be reported on a "dry-weight" basis, therefore it is very important to take a representative aliquot from the sample.

REFERENCE
US-EPA CLP Inorganics Statement of work ILM04.0, Exhibit D, Section 4, Part F

PRESERVATION & HOLDING TIME
Preservation: Store at 4 °C.
Holding Time: None stated in the regulations.

SAFETY
Assume that all samples contain potentially hazardous and/ or toxic material and should be handled with care. Safety glasses, gloves, and a lab coat should be worn whenever handling samples, reagents, or standards.

QC REQUIREMENTS
One duplicate and one blank per batch of twenty samples or less must be prepared and analyzed. The RPD for the SDUP %Solids must be $\leq$ 15% or the entire batch must be reprepared and reanalyzed.

INTERFERENCES
If the sample is an oily matrix, a constant weight may not be acheivable; document the problem in the benchbook and initiate a Corrective Action Record.

PROCEDURE

1.) Verify that oven temperature is within acceptance criteria (103 - 105 °C) and document the temperature in the Moisture benchbook.

2.) Each of the aluminum weighing dish has a number on the lip written with a sharpie marker. Verify that there sufficient clean, dry dishes with readable numbers and that there are no duplicate numbers in the set you are going to use. If you need to renumber a dish do it now. Place the dishes in the oven with lids on the bottom for at least 1 hour before going to the next step.

3.) Check the samples out of the cold room and allow them to come to room temperature. Arrange samples in numerical order to speed the weighing and recording process. Record the sample numbers and container letters in the Moisture benchbook.

4.) Calibrate the balance and record the event in the balance calibration benchbook.

5.) Carefully remove the dishes from the oven using gloves, so that no oil transfers from your skin, and place in a desiccator and allow the dishes to cool for about 5 minutes. Transport the desicator and the pans to the balance area where the samples are lined up.

6.) Carefully remove an aluminum dish from the desiccator and place it on the balance pan. Weigh the dish and the lid and record the ***tare*** weight (weight of the pan) with the corresponding pan number in your sample data benchbook.

7.) Write the sample number and container letter in the moisture benchbook, then open the sample container and use a spatula to place between 5 and 10 grams of samples into the pan. Record the exact ***initial*** weight (to at least 0.01g) of the pan plus the sample in the benchbook.

8.) Take the pan with sample off the balance and place on a ***clean*** countertop. Continue to weigh out all samples in this manner, repeating steps 6 and 7.

9.) Select a sample for duplicate analysis and prepare a second aliquot of this sample, recording its sample number clearly in the Moisture benchbook.

10.) After all samples have been weighed out, place samples in pans into the oven. Record the date and time in the Moisture benchbook.

11.) Leave samples in oven overnight, not less than 12 or more than 24 hours. Record the date and time samples were removed from the oven and the oven temperature at time of removal.

12.) When removing samples from the oven after drying, carefully place them in the desiccator and put the pan lids on. Use gloves throughout the procedure to avoid getting oils from your skin on the weighing pans and lids. Skin oils will increase the final weight and thus the moisture values. Let weighing pans and lids sit in the desiccator for about 1 minute to cool down before weighing to determine ***final*** weight of pan and dried sample.

13.) Enter data (tare weight, initial weight, final weight) into LIMS; LIMS will then calculate the %Solids, %Moisture and RPD of duplicate.

14.) Print the LIMS result sheet for the batch.

15.) Review that data against the benchbook entries to make sure there are no typographical errors & that the data makes sense (ie: if the soil was fairly dry, does the %moisture reflect that or does it imply that the sample was mostly water).

16.) Verify that the SDUP %Solids RPD is ≤ 15%. If the RPD is >15%, inform the Department Manager and start a Corrective Action Record; the entire batch will need to be re-prepared and reanalyzed.

Submit the LIMS result sheet and benchbook to a peer for review and signature, then turn the data in to the Department Manager.

QUICK ANALYSIS

If you can't wait overnight for moisture data use the following quickie technique:

1.) Perform steps 1-10 above, but remove samples after they have been in the oven for 4 hours.

2.) Place pan with sample in a dedicator until they're cool.

3.) Weigh, record the first ***final*** weight and place the sample & pan back in the oven.

4.) One hour after the recording the fist final weight, weigh the sample again.

5.) If the second ***final*** weight for the same sample agrees to within 0.01 grams of the first ***final*** weight, when weighed one hour apart, then the longer drying time is not required and the data may be used from either weighing event.

CALCULATIONS

LIMS calculates the %solids and %moisture, using the following equations:

$$\%Solids = \frac{\text{Dry weight of sample}}{\text{Wet weight of sample}} \times 100 = \frac{B - D}{A - D} \times 100$$

$$\%Moisture = \frac{\text{Wet weight of sample - Dry Weight of Sample}}{\text{Wet weight of sample}} \times 100 = \frac{A - B}{C} \times 100$$

A = initial (wet) weight of pan plus sample
B = final (dry) weight of pan plus sample
C = initial (wet) weight of sample = (A-D)
D = tare weight of pan

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Curtis & Tompkins, Ltd.

ACID DIGESTION
OF SOIL & SOLID SAMPLES

For Total Metals Analysis by ICP-AES and ICP-MS

EPA 3050B

Approved by:

Department Manager/ Date	QA Director/ Date

Read & Understood by:

Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date

Re-Approved by:

Signature/ Date	Signature/ Date

ACID DIGESTION OF SOIL & SOLID SAMPLES
For Total Metals Analysis by ICP-AES and ICP-MS
EPA 3050B

SCOPE

This procedure describes the acid digestion of solid samples for later analysis by ICP-AES and ICP-MS. This procedure is not applicable to the analysis of mercury (see EPA 7470 and 7471 for the mercury procedures). This procedure is *not* a total digestion technique but is a very strong acid digestion that will dissolve almost all elements that could become "environmentally available".

In this procedure, the sample is digested with nitric acid and hydrogen peroxide under heated conditions. This digestate is then refluxed with hydrochloric acid. This digestion procedure reduces interferences due to organic matter and converts metals that are adsorbed onto particulate matter into a form that can be determined by atomic absorption (flame AA) or inductively-coupled plasma spectroscopy (ICP). See the ICP and ICP-MS analysis SOPs for reporting limits.

Method Modification Note: Curtis & Tompkins uses the same procedure for both ICP and ICP-MS based on recommendation from the ICP-MS instrument manufacturer (Agilent). This procedure uses HCl to improve solubility of antimony, barium, lead, and silver. The ICP-MS instrument software includes correction factors for chloride and common chloride interferences.

Multi-Incremental (MI) Sampling Note: Some projects require the use of a 10 gram sample size, sampled "multi-incrementally". Procedures specific to MI samples appear in each applicable section.

REFERENCES

Sample Preparation:
EPA 3050B, *Acid Digestion of Sediments, Sludges, and Soils,* SW-846, Update 3, Dec.1996
CS SOP 2.3, Subsampling & Compositing
ASTM D 6323-98, Standard Guide for Laboratory Subsampling of Media Related to Waste Management Activities (Reapproved 2003)

Subsequent Analytical Method:
EPA 6010B, *Inductively Coupled Plasma-Atomic Emission*, SW-846 Update 3, Dec 1996
EPA 6010C, *Inductively Coupled Plasma-Atomic Emission*, SW-846 Feb 2007
EPA 6020, *Inductively Coupled Plasma-Mass Spectrometry*, SW-846 Update 3, Dec 1996
EPA 6020A, *Inductively Coupled Plasma-Mass Spectrometry*, SW-846 Feb 2007

Additional SOPs and Guidance Documents:
NELAC Chapter 5, Quality Systems, June 2003
DoD Quality Systems Manual, Version 4.1, April 2009
C&T SOP QA 1.4, *Balance Calibration Check & Maintenance*

C&T SOP QA 1.6, *Pipet Calibration Check Procedures*
C&T SOP QA 4.1, *Establishing Control Limits*
C&T SOP QA 4.4, *Determining Method Detection Limits (MDL)*
C&T SOP QA 8.4, *State Program Requirements*
C&T SOP QA 8.5, *Federal Program Requirements*
C&T SOP CS 2.4, *Multi-Incremental Subsampling*

PRESERVATION & HOLDING TIME

Preservation: Store at 4°C
Holding Time: 6 months

SAFETY

This procedure involves the use of strong acids and reagents that *will* cause injury if allowed to contact skin or eyes. Assume that all samples contain hazardous and/ or toxic chemicals. Wear a lab coat, gloves, and safety glasses whenever handling samples, standards, or reagents.

EQUIPMENT

Disposable 50 mL digestion tubes, SPC Science Catalog# 010-500-261
    (or 250 mL beaker with watch glasses sized to fit the beakers)
Auto-pipette, adjustable to 0.5mL
Thermometer, Range 0-220°C
Digestion Block - adjustable and capable of maintaining a temperature of 90-95°C
Glass Funnels
Whatman # 541 Filter paper
    (# 541 is "ashless", specifically for trace metals, & reduces sodium contamination)
50mL graduated plastic centrifuge tubes, VWR cat#21008-973

<u>Additional/alternate equipment for MI Samples</u>
600 mL beakers with ribbed watch glasses
500 mL graduated cylinder
Hotplate, adjustable and capable of maintaining a temperature of 90-95°C

INTERFERENCES

Lead and zinc are common contaminants present in everyday dust; keeping the sample prep area clean and dusted will reduce these contaminants, as will loosely covering the digestates during the heating steps. Soils containing high levels of carbonates may foam when acid is added; add the acid slowly or use a smaller sample size.

Volatile elements (particularly antimony) may be lost during the digestion process if the digestate is superheated or allowed to go dry during heating. Silver may precipitate during the digestion process if present in relatively high levels; samples submitted by photo-processing or reclamation clients (Dean X-Ray, Safety Kleen, etc.) should not be digested prior to analysis for silver. Standards should be stored away from light to prevent photo-induced precipitation of silver.

QC REQUIREMENTS

A preparation blank (BLANK), blank spike (BS), blank spike duplicate (BS), sample spike (SSPIKE), and sample duplicate (SDUP) are digested and analyzed with each batch of 20 samples or less. If a client requests that a matrix spike (MS) and matrix spike duplicate (MSD) be analyzed on their sample, these should be analyzed in place of the SSPIKE and SDUP.

Purchase Class-A disposable digestion tubes; keep the certificate of analysis on file for each lot of tubes received. If Class-A tubes are not available, the calibration of the disposable digestion tubes must be verified, to within 3%, for each lot received. The temperature setting for the hot block & DigiProbe must be verified, and documented, at least annually. A method detection limit study will be conducted annually by digesting and analyzing seven aliquots of a low-concentration laboratory control sample.

BATCH QC DEFINITIONS

The following samples must be prepared with every batch of 20 or fewer samples.

1.) Prep Blank (BLANK): A method or prep blank is an aliquot of deionized water that is carried through the entire digestion and analysis procedure to demonstrate that the process is free of *contamination* and is not contributing to the detected sample concentrations. If elements of interest are detected in the prep blank at levels greater than the reporting limits, the batch must be re-digested and reanalyzed for that element.

2.) Blank Spike (BS) and Blank Spike Duplicate (BSD):
Blank spikes are aliquots of deionized water that are carried through the digestion and analysis procedure to demonstrate the accuracy (recovery) and precision (RPD) of the process in the absence of matrix interferences. If the recovery or RPD of any element of interest fails the QC limits, the entire batch must be re-digested and reanalyzed for that element.

3.) Sample Duplicate (SDUP):
Sample duplicates are aliquots of a real-world sample that are digested and analyzed with each batch to demonstrate the precision of the process in samples that may contain or cause matrix interferences. If the RPD of an element of interest fails the QC limits, the spikes may need to be re-digested and re-analyzed.

4.) Sample Spike (SSPIKE):
Sample spikes are aliquots of a real-world sample that are digested and analyzed with each batch to demonstrate the accuracy of the process in samples that may contain or cause matrix interferences. If the recovery of an element of interest fails the QC limits, the spikes may need to be re-digested and re-analyzed.

PROCEDURE

1.) Calibrate the autopipette and document the results in the pipette benchbook.

2.) Calibrate the balance and document the results in the balance calibration benchbook.

3.) Turn on the digestion block. Place a digestion tube containing 50mL DI water in the block and place the "DigiProbe" temperature probe into this digestion tube. Allow the block to heat until the DigiProbe reads 95°C (usually takes 20 - 30 minutes).

    MI samples: Turn on the hotplate. Place a covered beaker with 200mL water and a calibrated thermometer on the hotplate. Allow to heat until the temperature reaches 95°C (usually takes 20 - 30 minutes).

4.) While the block (or hotplate) is heating, check samples out of the coldroom and allow them to come to room temperature.

5.) Write the sample number and bottle *letter* of each sample in the digestion log.

6.) Label disposable digestion tubes (or beakers for MI samples) with the sample numbers, including a MB, BS, BSD, SSPIKE, and SDUP (or MS and MSD if needed).

7.) Clean the spatula prior to use, using DI water and clean Kimwipes.

8.) Discard the top ~1cm of sample, to ensure that the aliquot used was not contaminated by the field equipment.

    Note: Discard any leaves, twigs, large stones, etc and take a visually representative aliquot of each sample. Document your observations and actions (ie: "discarded leaves & twigs") in the prep log.

9.) Using the same spatula, thoroughly homogenize the next several cm of sample, to achieve homogeneity then weigh 1g ($\pm$ 0.1g) of sample into the disposable digestion tube labeled with that sample number. Record the weight of sample (to 0.01g) in digestion benchbook.

    Note: If a client requests that C&T "composite" the samples, see Appendix_3 for instructions.

    MI samples: Follow the procedures in the Multi-Incremental Sub-sampling SOP to obtain a 10 gram sample.

10.) Wipe off the spatula with a Kimwipe, then rinse it in clean DI water and dry it with another clean Kimwipe. Thorough cleaning between samples ensures that elements present in one sample are not carried into the next sample and so do not create false positives or a high bias on the reported results.

11.) For the Method Blank (MB), start with the empty tube and add only reagents throughout digestion.

12.) For the Blank Spike (BS), use a calibrated autopipette to add 0.5 mL of Solution_A and 0.5 mL Solution_B (see Appendix_2) to the empty digestion tube labeled "BS". (MI Samples: Use 5.0 mL)

13.) Repeat, with the tube labeled "BSD", for the Blank Spike Duplicate (BSD). Record the volume added and the LIMS SS# of the spike in the digestion log.

14.) Review the job sheets to determine if any of the clients in the batch requested that matrix QC be done on their sample. If so, use that sample for the SSPIKE and SDUP (or MS/MSD), otherwise choose a sample for batch QC so that matrix QC is rotated throughout the laboratory's clients and so that no one client's samples predominate over a period of time.

15.) Thoroughly homogenize about 10g of the sample selected as the batch QC sample, before taking any aliquots. (Does not apply to MI samples)

16.) For the sample spike (SSPIKE), weigh a second 1g ($\pm$ 0.1g) aliquot of the sample chosen for batch QC into the labeled digestion tube. Record the weight in the benchbook, then use a calibrated autopipette to add 0.5 mL of Solution_A and 0.5 mL Solution_B. (MI samples: use a 10 gram sample and 5.0 mLs of each spiking solution.)

17.) For the SDUP, weigh a third 1g aliquot of the sample chosen for batch QC into the digestion tube labeled "SDUP". (MI samples: use 10 grams)

Note: If a client requests an MS/MSD on their sample, prepare two aliquots of the SSPIKE (and call them "MS" and "MSD" respectively) in place of the SSPIKE and SDUP.

18.) Add 5 mL of 1:1 nitric acid (HNO_3) to each tube. (MI samples: use 50 mLs) Record the C&T ID of the nitric acid in the digestion benchbook.

19.) Place the tubes in the 90-95°C digestion block for 10-15 minutes *without boiling* (MI samples, place beakers covered with ribbed watch glasses on the hotplate), then remove from block and allow to cool to room temperature.

20.) Add 2.5 mL concentrated nitric acid (MI samples, use 25 mL), return to the digestion block (or hotplate) and reflux for 30 minutes. If brown fumes persist, repeat this step until no further brown fumes are produced.

21.) While the samples are digesting, record the C&T reagent ID of the 1:1 HNO_3, the manufacturer and lot# of the nitric acid in the digestion benchbook.

22.) Reduce the volume to about 5 mL (50 mLs for MI samples) without boiling or allowing it to go to dryness.

Note: If the sample volume will not reduce to 5 mL (50 mLs for MI samples), digest for an additional 2 hours, then continue with the steps below.

23.) Remove the test tubes from the block digester (or beakers from the hotplate) and cool to room temperature.

24.) Using a calibrated autopipette, add 1 mL (10 mLs for MI samples) water and 1.5 mL of 30% (as purchased) hydrogen peroxide (15 mLs for MI samples) and swirl tube. Record the C&T ID of the peroxide in the benchbook.

25.) Return to digestion block (or hotplate) and warm until effervescence subsides.

Note: If the sample foams over on additional of hydrogen peroxide, re-digest the sample using a smaller sample weight and note the problem in the digestion log.

26.) Continue adding 0.5 mL portions (5.0 mLs for MI samples) of 30% hydrogen peroxide and heating until sample appearance is does not change (do not exceed 5 mL or 50 mL for MI samples).

27.) Reduce the sample volume to 5 mL again (50 mLs for MI samples), without boiling or allowing it to go dry.

28.) Add 5mL concentrated HCl (50 mLs for MI samples) and swirl tube to mix thoroughly. Record the HCl manufacturer and lot# in the benchbook.

29.) Return the tubes to the digestion block (or hotplate) and heat at 95°C for 15 minutes.

30.) Remove the tubes from the digestion block (or hotplate) and cool to room temperature.

31.) Cool and bring to 50 mL volume with deionized water. (MI samples: Bring to 500 mLs in a clean, acid-rinsed 500 mL graduated cylinder.)

Method Modification Note: C&T uses a digestion block in place of the hot plate digestion discussed in 3050B because the block provides better temperature control and uniform heating across the samples. The final volume by this procedure is 50mL instead of 100mL as discussed in 3050b, because using the 50mL disposable digestion tubes for the entire process provides a complete digestion while eliminating potential cross-contamination. The reagent volumes have been adjusted for the 1g sample weight and lower final volume.

32.) Cap, invert and shake tube several times to ensure good mixing. (Mi samples: cover cylinder with parafilm.)

33.) Label clean, dry 50 mL disposable centrifuge tubes with the sample IDs.

34.) Filter the sample through Whatman # 541 filter paper into the appropriate centrifuge tube, or allow sample to settle and then decant the top portion (excluding any settled matter) into the centrifuge tube.

Note: If any of the samples are filtered, the batch QC must also be filtered and the filtration must be documented in the digestion benchbook.

35.) Complete benchbook entries, enter batch data into LIMS, and have the benchbook and LIMS prep entry sheet peer-reviewed.

36.) Transfer custody of the samples to the analyst.

DELIVERABLES AND DOCUMENTATION REQUIREMENTS

A copy of the preparation log page where the samples were digested must accompany the paperwork for these samples. The benchbook entries must include:

Date sample digestion
C&T sample ID's (including container letter), initial and final volumes digested
Identity of QC Samples (spikes, duplicates & LCS) amount of spikes added
Record of whether or not the digests were filtered
LIMS numbers of all spiking solutions
ID of all reagents used
Any unusual occurrences during digestion.

POLLUTION PREVENTION

The digestion should be performed in a fume hood. No other pollution prevention measures are currently applicable to this analysis, except for the proper disposal of the samples.

WASTE DISPOSAL

All digests are kept for at least 6 months prior to disposal. After 6 months, the digests are included in the 'Corrosives' waste stream.

REVISION HISTORY.

This is revision 10 revision 9 was modified as follows

- Multi-Incremental (MI) procedures were added

APPENDIX_1:

ICP or ICP-MS
SOIL DIGESTION SUMMARY
EPA 3050B

Sample Weight:	1g (± 0.1g)
Spike:	0.5 mL each of SS2A1 and SS2B1
1:1 Digestion:	+ 5 mL 1:1 HNO_3 95 °C 10-15 minutes
Conc. HNO_3 Digestion:	+ 2.5 mL concentrated HNO_3 95 °C 30 minutes repeat until no brown fumes are produced reduce volume to < 5mL (or digest for 2 hours)
H_2O_2 Digestion:	+ 1.0 mL DI water and 1.5 mL 30% H_2O_2 95 °C add 0.5 mL 30% H_2O_2 until no effervescence and appearance is stable reduce volume to < 5mL (or digest for 2 hours)
HCl Digestion:	+ 5mL concentrated HCl 95 °C 15 minutes
Final Volume:	50 mL
Filtration:	if particulates present in sample Whatman # 541 filter QC samples if any sample filtered

APPENDIX_2: REAGENTS & STANDARDS

Alternate supplies may be used so long as they are of equivalent quality and all other quality control, and traceability requirements are met.

REAGENTS

Those reagents that are used as purchased should be labeled with the date opened & initials of chemist who opened it and the expiration date. If an aliquot of a reagent is decanted into another bottle (to reduce changes of contamination, for example), that bottle must be labeled with the contents, concentration, date on which it was decanted, prep chemist's initials, and expiration date of the original reagent.

For those reagents that require additional preparation, including dilutions into DI water, the prep must be documented in the reagent prep benchbook. Assign each reagent a unique ID, based on the manufacturer and the date prepared. Any reagents that are not prepared daily should be labeled with the contents, reagent ID, concentration, date prepared, prep chemist's initials, and expiration date.

Each reagent lot should be checked prior to analysis to verify that the levels of impurities are within acceptable levels. Place a copy of the vendor's Certificate of Analysis in the reagents benchbook.

Nitric acid (HNO_3), concentrated, Instra-Analyze (trace metals) grade,
JT Baker, VWR catalog # JT9598-34
Store at room temperature for up to 1 year.

1:1 Nitric acid (HNO_3) *Warning:* Always add acid to water, as reversing the process may cause hot acid to splatter and cause chemical burns.

Partially fill an empty HCl bottle with 500mL of DI water. Slowly add 500mL of concentrated HCl to the deionized water. Cap tightly then carefully invert 3 times to mix.
Store at room temperature for up to 1 year.

Hydrochloric acid (HCl), concentrated, Instra-Analyze (trace metals) grade,
JT Baker, VWR catalog # JT9530-33
Store at room temperature for up to 1 year.

30% Hydrogen Peroxide (H_2O_2) as received,
VWR, 500mL, catalog # VW3690-1
Store at room temperature for up to 1 year.

SOURCE STANDARDS

Source standards are those purchased from a chemical manufacturer or vendor, and should be NIST traceable. For source standards, the LIMS S-name is unique to both the composition (compound list) of the standard *and* to the vendor of that standard. A new S-name must be assigned whenever the composition is changed or when the standard is obtained from a different vendor; the information must then be entered in the "Standard Definitions" table before the new standard is assigned an S#. If you need more details, log into the LIMS browser; follow the 'LAB MENU' link and click on the "New Standards System (March 2005)" link for details on the system.

Certificates of Analysis should be obtained from the vendor of each source standard; each standard should be traceable to NIST. Source standards usually have an expiration date set by the manufacturer. If no expiration date is listed, the expiration date is **1 year** from the date received, or sooner if comparison with check standards indicates a problem.

Enter the lot#, date received, and expiration date of each source standard into LIMS immediately upon receipt, using the Standards Menu "Standard Inventory".

Write the S# and the date received on the 'Certificate of Analysis' that accompanied the standard; if the supplier did not provide a certificate, call and request that a copy be faxed. The Certificate of Analysis must be kept on file in the appropriate 3-ring binder.

Store source standards at room temperature, away from light (to prevent photo-induced precipitation of silver). If the Certificate of Analysis or bottle label did not include an expiration date, assign an expiration date of one year from the date received.

Spiking Solutions are purchased as custom standards from CPI and used without an intermediate dilution.

Spiking Solution A *LIMS S-Name:* **SS2A1**

Element	Concentration (µg/mL)	Element	Concentration (µg/mL)	Element	Concentration (µg/mL)
Aluminum	2,000	Cobalt	50	Selenium	100
Arsenic	100	Copper	25	Silver	20
Beryllium	5	Iron	2,000	Sodium	2,000
Boron	100	Magnesium	2,000	Thallium	100
Cadmium	20	Manganese	50	Vanadium	50
Calcium	2,000	Nickel	50	Zinc	50
Chromium	200	Potassium	1,000		

Spiking Solution B *LIMS S-Name:* **SS2B1**

Element	Concentration (µg/mL)	Element	Concentration (µg/mL)
Antimony	200	Molybdenum	40
Barium	200	Tin	100
Lead	200	Titanium	100

APPENDIX_3: COMPOSITING SOIL SAMPLES

Clients may ask C&T to "composite" samples during preparation, to yield an average result instead of running each sample as a discrete sample. If a composite is requested, use the following steps to create a representative sample and document the composite:

1.) Verify that the balance has been calibrated earlier in the day. If it has not, calibrate it before continuing. Use a minimum of 1g of each sample being added to the composite, as we need to take subsamples that are representative of the entire contents of each core or bottle.

2.) Group the samples to be included in the composite and determine what size container will be needed to create more than enough of the composite for all of the analyses needed.

3.) Label a pre-cleaned container with the C&T sample number of the composite.

4.) Place the container on the scale and tare the scale.

5.) Using a clean spatula or equivalent tool, remove and discard the top ~1cm from the first sample sleeve. Discard any leaves, twigs, large stones, etc and take a visually representative aliquot of each sample. Document your observations and actions (ie: "discarded leaves & twigs") in the prep log.

6.) Using the same spatula, thoroughly homogenize the next several cm of sample then weigh the necessary aliquot out of this homogenized fraction.

7.) Clean the spatula or tool between samples using deionized water and a clean paper towel, to ensure that there is no contamination between the discrete samples.

8.) Repeat Steps 5-7 for each of the remaining samples to be included in the composite, using exactly the same weight for each aliquot.

9.) In the appropriate analysis or Soil Aliquot benchbook, write the C&T sample number of the composite, along with the sample numbers, bottle letters, and weight used from each of the discrete samples being included in the composite.

Example:	162689-001	comp -001 A-D, 15.0g of each
	172014-001	comp -1A, -2A, -3A, 20.0g of each

Note: When using composites that have been previously prepared, write "premade comp", "xlab comp", etc. under the Comments/Observations heading.

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NITROAROMATICS & NITRAMINES

EPA 8330

Approved:

Department Manager/ Date	QA Director/ Date

Read, Agreed & Understood:

Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date

Re-Approved:

Department Manager/ Date	QA Director/ Date

Curtis & Tompkins, Ltd.

EPA 8330 - NITROAROMATICS & NITRAMINES
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EPA 8330 - NITROAROMATICS & NITRAMINES

SCOPE

This procedure describes the identification and quantitation of certain high energy (explosive) Nitroaromatics and Nitramines that have previously been extracted from liquid and solid (soil) samples into acetonitrile. Target compounds separated on an LC reverse phase column are reported from the UV Detector using the 254 nm signal. Presumptive positive results from one LC column are confirmed on a second LC column, which substantially changes the elution order of the target compounds. The two columns used are the LC-18 reverse phase column and the ABZ+PLUS AMIDE reverse phase column. High concentration aqueous samples may be diluted and analyzed without extraction.

See Appendix 6 for Curtis & Tompkins' compound list and standard reporting limits.

REFERENCES

Analytical Methods:

EPA 8330	Nitroaromatics and Nitramines by High Performance Liquid Chromatography, SW-846, September 1994, Revision 0
EPA 8330A	Nitroaromatics and Nitramines by High Performance Liquid Chromatography, SW-846, January 1998, Revision 1
EPA 8000C	Determinative Chromatographic Separations, SW-846, March 2003

Extraction Methods:

EPA 8330	Nitroaromatics and Nitramines by High Performance Liquid Chromatography, SW-846, September 1994, Revision 0
EPA 3535	Solid Phase Extraction (SPE), SW-846, Revision 0, Dec 1996

Related C&T Procedures & Other Guidance Documents:

SVOC SOP 7.2.1, '8330 QC Acceptance Limits, Table-1'
XLAB SOP 2.4, 'Solid Phase Extraction of Aqueous Samples for EPA 8330'
XLAB SOP 3.6, 'Sonication Bath Extraction of Soil Samples for EPA 8330'
QA SOP 1.5, Calibrating & Maintaining Temperature Controls
QA SOP 1.6, Pipet Calibration Check Procedures
QA SOP 4.1, Establishing Control Limits
QA SOP 4.4, Determining Method Detection Limits (MDL)
QA SOP 8.4, State Program Requirements
QA SOP 8.5, DoD Program Requirements
QA SOP 8.6, DoE Program Requirements
QA SOP 9.6, Insuring Compliant Manual Integration
NELAC Chapter 5, Quality Systems, June 2003
DoD Quality Systems Manual, rev 4.1 April 2009
DoE Quality Systems Manual, Version 2.2, Oct.2006
Operator Manuals for Agilent 1100 & 1200 Series Liquid Chromatograph

PRESERVATION & HOLDING TIME

Sample Preservation: Store at 4^oC. pH < 3 with HCl *

Sample Holding Time: Water: 7 days from collection to extraction
Soil: 14 days from collection to extraction

Extract Holding Time: 40 days from extraction to analysis. Store extracts at 4^oC ($\pm$ 2^oC)

* *Method Modification:* 40CFR136.3 Table 2 and SW-846 Table 2-36 do not require acidification for this analysis, C&T's standard compound list includes Tetryl, which should be acidified to obtain acceptable recovery. Since the sample is extracted directly from the sampling container and thorough acidification and homogenization of samples after collection is difficult, C&T supplies pre-preserved liter ambers. If client's target compound list does not include Tetryl, the samples do not have to be acidified.

SAFETY

The target compounds for this analysis include explosive compounds, their pre-cursors, and breakdown products. Samples and extracts should never be exposed to heat above ambient temperature. Always wear safety glasses and gloves when handling samples, extracts or standards.

QC REQUIREMENTS

A method blank (MB), laboratory control sample (LCS), matrix spike (MS) and matrix spike duplicate (MSD) are extracted and analyzed with each batch of twenty samples or less. A blank spike (BS) and blank spike duplicate (BSD) replace the LCS/ MS/ MSD if the client submitted insufficient sample volume for MS/MSD. One surrogate compound (1,2-Dinitrobenzene) is added to every sample, method blank and spike to monitor the extraction and analysis, and to each standard to verify that the extract was injected correctly.

A Continuing Calibration Verification (CCV) standard is analyzed at the beginning of each sequence, after 12 hours (normally every ten samples), and at the end of the analytical run. The %D for each compound should be $\leq$15% or instrument maintenance should be performed. See the 'CCV' section below for additional details regarding corrective actions required for CCV failures.

A multi-point initial calibration is performed to establish the working range of the instrument, using a minimum of five points for each compound. If the average calibration factor is used for quantitation, the %RSD for this initial calibration must be $\leq$ 20% for each target compound. If linear response is used for quantitation, the linear coefficient (r) must be $\geq$ 0.995 (r^2 then is $\geq$ 0.99). An initial calibration verification (ICV) standard obtained from a second source must be analyzed immediately following the initial calibration, with a %D $\leq$ 15% for each compound.

The surrogate and spike acceptance limits are generated semi-annually using control charts. See the associated SOP '8330 QC Acceptance Limits, Table-1' for current in-house limits. A method detection limit (MDL) study is performed annually by preparing and analyzing a minimum of seven replicates of a low-spiking-level laboratory control sample.

EQUIPMENT

HPLC04: Agilent Model 1100, Auto Sampler 1313A, Agilent AG.G1315B & Ag.G1321A detectors
HPLC05: Agilent Model 1200, Agilent G1329A autosampler, Agilent Ag.G1321A & G1315B detectors

Analytical Columns: 25 cm x 4.6mm ID, 5 µm SUPELCOSIL LC-18, Supelco Cat. # 58298
25 cm x 4.6mm ID, 5 µm SUPELCOSIL ABZ+PLUS, Supelco Cat. #59197

Filters: Whatman Mini-Uniprep Syringeless Filters, 0.45µm PTFE Filter, VWR Cat.# 28137-758
Supelco Pre-Column Filter, 2µm frit, Supelco Cat# Z227331

Data Acquisition & Processing Software: HP/Agilent Chemstation

DAILY INSTRUMENT SEQUENCE

See Appendix_4 for Instrument Conditions and procedures.
See Appendix_5 for Instrument Maintenance procedures
See Appendix_8 for Initial Calibration requirements and procedure
See Appendix_10 for HP ChemStation data-system parameters and procedures.
See Appendix_11 for instructions on using the LIMS Paperless system.

Each sequence should begin with an instrument blank followed by Continuing Calibration Verification (CCV) standard. Once the CCV recovery has passed the ≤15%D acceptance criteria, sample extracts may be added to the sequence. Additional CCV's must be analyzed after every ten samples, including batch QC samples, and at the end of the sequence. The concentration of the CCV's must be varied within the calibration range, excluding the highest or lowest points.

Prepare a data system sequence for the analysis of a batch of samples. Verify that the dilution/ concentration factor is entered correctly and that the correct method file is selected. Sample sequences should be limited to no more than one batch, to keep data processing simple. A typical analytical sequence is:

Instrument Blank
Nitroaromatics and Nitramines CCV
Instrument Blank
Method Blank
LCS (If applicable)
Matrix Spike or Blank Spike
Matrix Spike Duplicate or Blank Spike Duplicate
6-7 Samples (depending on whether an LCS/MS/MSD or BS/BSD was analyzed)

Nitroaromatics and Nitramines CCV
Instrument Blank
10 Samples
Nitroaromatics and Nitramines CCV

Each sequence must end with the analyses of a Nitroaromatics and Nitramines (NAN) CCV regardless of the number of samples analyzed.

If high levels of target analytes are known or suspected, analyze an instrument blank immediately following the sample to verify the absence of carryover into the next sample. If very high levels are detected in a sample and an instrument blank was not analyzed immediately after the high-level sample, examine the data of the subsequent samples to determine whether carry-over may have contributed to the sample results. If carry-over is suspected, reanalyze the affected sample to confirm the absence of carry-over contributions.

Although the current SW-846 methods allow up to twenty runs between CCV's, C&T normally runs CCV's after every ten samples to meet the additional SW-846 requirement that no more than 12 hours should elapse between CCV's and to reduce the number of reanalyses caused by failing CCV's.

Note: If the instrument will be running unattended or overnight, it is a good idea to load two CCV standards for each bracket, to reduce the number of samples that have to be reanalyzed due to an injection error.

File Naming Conventions
The first three characters of the data file name are the Julian day; the files are written to the G:\HPLC##\DATA\ subdirectory for the instrument "##" in use. The software method name is the name of the column being used; it is very important to select the correct method, as Chemstation controls the instrument.

1.) CCV (Continuing Calibration Verification):
A CCV (Continuing Calibration Verification) standard must be analyzed, and pass the 15%D acceptance criteria, prior to any sample extract analysis, to verify that the response of the instrument has not changed significantly and that the curve may still be used to quantitate sample results.

1.1) Decide what CCV standards to analyze, keeping in mind that the concentrations must be alternated across the mid-levels of the calibration curve. CCV standards are prepared at three concentrations and are designated Low (L), Mid-level (M), and High (H).

Note: The USACE recommends that the ICAL standards be used as CCV's, in order more readily determine if problems are due to changing instrument conditions and are not due to differences between standards.

1.2) Load CCV standards after every ten samples and at the end of the sequence, including batch QC but excluding instrument blanks and other standards in the count.

LIMs identifies samples that are associated with the DoD QSM 4.1 requirements, other DoD requirements or commercial clients. It identifies all project specific criteria that are reviewed by the analyst before sample analysis.

For sequences containing samples that are not associated with requirements from DoD QSM 4.1, if the instrument is running unattended or overnight, it is a good idea to load two CCV standards for each bracket, to reduce the number of samples that have to be reanalyzed due to an injection error. Enter the sequence with an "x" stype for the second CCV so that only the first CCV will automatically process.

For sequences where both DoD QSM 4.1 samples and non-DoD QSM 4.1 samples are analyzed, both sets of CCVs will be run and integrated and both CCVs must pass the DoD QSM 4.1 criteria. If the entire sequence contains DoD QSM 4.1 samples only, then only one CCV will be analyzed.

1.3) Analyze the standards using the same data acquisition method as for the samples, typing "CCV," before the working standard number, so that LIMS will automatically generate a Continuing Calibration Verification summary, which compares the calculated concentrations from this run to the known concentrations of the standard.

1.4) Examine the CCV summary to verify that each %D is $\leq$ 15%.

1.5) If the acceptance criteria are not met, examine the integration to verify that each peak was correctly integrated. Manual integrations must be consistently applied to standards, QC and samples. LIMS will retain both the original and the reintegrated chromatograms in the sequence raw data. If manual integrations or baseline corrections are performed, resend the file to LIMS and generate a new CCV summary.

Alteration of peak integration solely to pass calibration or QC criteria is illegal and is grounds for immediate termination.

1.6) If the acceptance criteria are not met, analyze another CCV standard. If the second analysis of the standard fails to meet the criteria, recalibrate and/or perform other instrument maintenance.

If two CCV's were analyzed, examine the first one against the acceptance criteria; if it fails, "x" out the first CCV, change the second to stype "CCV" and process the data from the second CCV. _Do not_ "cherry pick" some compounds from the first CCV and others from the second CCV; if the second CCV is processed and used, all compounds must be taken from the second standard.

1.7) If the CCV's fail acceptance criteria, data may be reportable based on the following criteria:

a.) If the failing compound is not a target analyte for the associated samples, sample results should be reported without reanalysis.

b.) If the compound fails the %D criterion due to a high response but was not detected above the reporting limit in the associated samples, the sample results may be reported without reanalysis, as the high bias does not affect the sample results.

c.) If the compound fails the %D criterion due to a high response and *was* detected above the reporting limit in any of the associated samples, the samples must be reanalyzed.

d.) If the compound fails the %D criterion due to a low response and *was* detected (even below the reporting limit), the sample must be reanalyzed.

Load additional CCV's after every ten samples and at the end of the sequence. The standard concentration used for the CCV should be alternated over the course of the sequence. See Appendix_1 for calculation of %D.

Recommendation: Although SW-846 methods 8000B and 8310 do not require, or even discuss, the analysis of continuing calibration blanks (CCBs), at least one instrument blank (IB) should be analyzed, usually at the beginning of each sequence, with the first set of CCVs; don't load instrument blanks before each CCV, as some validators consider this a questionable practice. The instrument blank is used to demonstrate that the analytical system is not contributing to the analytical results. If any target compounds are detected in this blank at levels greater than ½ the reporting limit, determine the source of the contamination and correct the problem before continuing with sample analysis.

2.) Update Retention Times:
The center of the retention time windows may need to be adjusted periodically in order for the data system to correctly identify all the compounds in the data. Update the absolute retention times whenever a drift is noticed in the retention times of the continuing calibration verification (CCV) standards. Do not adjust the RT *windows* as these are determined from a 72-hour sequence; see Appendix_7 for discussion of RT windows.

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2.1) For short sequences, use the retention times from the first CCV. For long sequences, use either a mid-level CCV or the average of the retention times from the first and final CCV.

2.2) Enter the new midpoint RT's into the Chemstation Calibration Table. (See Appendix_10 for Chemstation procedures.)

Method Modification Note: SW-846 method 8000B suggests updating retention times daily. However the retention times are fairly stable and should not need daily updating. C&T updates retention times only when drifts are observed in the CCV retention times.

3.) Prepare the Sample and Batch QC Extracts for analysis

3.1) Remove the extracts from the extraction lab refrigerator and let the extracts warm to room temperature.

3.2) Collect sufficient push-filter vials for the batch and label each with a sample number.

3.3) Aliquot 500 µL of the extract and 500 µL Millipore DI water into an autosampler vial and mix well.

Method Modification: Since C&T uses Solid-Phase Extraction (SPE) instead of the salting-out procedure, the extracts and standards are diluted with DI water instead of the 5% $CaCl_2$ solution described in 8330.

3.4) Transfer the diluted extract into a push-filter vial and push down the top to filter.

3.5) Transfer approximately 200 µL of the filtered extract to a labeled autosampler vial with insert and seal with a crimp cap.

3.6) Return the undiluted, unfiltered extract to the refrigerator so that the remaining extract can be used for any reruns.

Note: Nitrobenzene and nitrotoluene are readily lost once the septum is punctured, even if refrigerated. Don't re-use the same aliquot unless it can be reanalyzed immediately or the cap is quickly replaced after the original analysis.

3.7) Repeat for each sample.

3.8) Place the samples on the autosampler tray beginning with the lightest colored extracts followed by more highly colored or viscous extracts.

3.9) If dilutions are required, see Appendix_3 for instructions on preparing the dilutions.

If a dilution is needed to bring one or more analytes into the calibration range, prepare the dilution so those analytes fall in the middle of the calibration range to reduce the likelihood of bias that typically affects the extreme high or low regions of the curve.

QUALITATIVE ANALYSIS

4.) Peak Identification

Identification of compounds is based on comparison of the peak retention times in the sample to the retention times of the peaks in the mid-level initial calibration standard. For the standards, all compounds must fall within its retention time window and be automatically identified by the data system.

5.) Integration

Determine whether manual integration is necessary by examining the sample chromatogram.

- For samples in which no matrix interferences are present, the sample peaks should be integrated in the same fashion as the calibration standards.
- For samples in which interferences raise the baseline, integration of the target compounds should be done on a valley-to-valley basis, unless a nearby negative peak would contribute a positive bias to the reported result; if a negative peak is present, use a baseline event to extend the baseline horizontally across the dip.

If the reason for the manual integration is not intuitive and obvious from the chromatogram, document the reason for the integration on the raw data, and date and initial the comment.

If manual integration is necessary there are a number of different baseline events to choose from. If no baseline events are chosen, Chemstation draws a baseline based solely on peak separation criteria. If a baseline event was used, Chemstation will flag the user report at the time of the baseline event; see Appendix 10 for a listing of these flags and LIMS will save both the original and the reprocessed data.

If peak identification or quantitation is prevented by the presence of interferences, a cleanup may be required. Discuss the chromatograms with the Department Manager to determine if cleanup is required.

Warning: Unsubstantiated alteration of peak integrations solely to pass QC criteria (ie: calibration, surrogate) is ***illegal*** and is grounds for immediate termination of employment.

QUANTITATIVE ANALYSIS

Analyte quantitation is done using the external standard technique. Quantitation is based on comparison of the area of the target compound to the initial calibration curve for that compound, with adjustments for the sample preparation concentration factor and instrument dilution factor. See Appendix_1 for example calculations. Concentrations are expressed as micrograms per liter (µg/L) or micrograms per kilogram (µg/Kg).

All results are reported on a wet-weight ("as received") basis unless otherwise requested by the client. If the client requests 'dry-weight' corrections, the 'wet-weight' results in the results database are corrected for moisture by LIMS when producing the final report forms.

6.) Evaluate the Sample Results

A Chemstation report will be automatically generated once the run is complete. Send the data to LIMS. Review the batch QC sample data to verify that samples from that batch can be reported. After the QC has been deemed acceptable, review the sample results to identify any samples that need to be rerun, diluted, and/or run on the second column for target compound confirmation.

Verify that the target compounds are correctly integrated, then determine if any target compounds were detected above the reporting limit, or above the MDL for those clients that require J-flagged data. If any target compounds were detected at reportable levels, that extract must be reanalyzed on a second column to confirm the identity of the compound.

After the extracts have been run on both columns, when necessary, examine the results to determine how to report the data.

6.1) Determine if a result should be reported by reviewing the data from both columns. To be reported, the analyte must be detected on both columns. A hit is considered a false-positive and reported as 'ND' if:

a. a peak is present on one column but not on the other,

b. the peak on the confirmation column falls outside the RT-window,

c. results are not being "J-flagged" between the RL and MDL,

c.1 and the result on the quantitation channel is $\geq$2x the reporting limit but less than the reporting limit on the confirmation channel, or

c.2 the result on the quantitation channel is <2x the reporting limit but less than ½ the reporting limit on the confirmation channel.

Note: J-to-MDL flagged hits on primary channel will be confirmed by J-to-MDL flagged hits on the confirm channel.

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6.2) If an analyte is detected on both columns with an RPD of ≤ 40% between the two results, report the higher of the two concentrations.

Note: Client-submitted Quality Assurance Project Plans may specify that the lower of the two results be reported. For these jobs, make sure to narrate this as a client-specific requirement on the 'Data Review Checklist'.

6.3) If the RPD > 40% between the two columns, evaluate the chromatograms for any co-eluting contaminants that may be causing the high RPD.

a. If coelution is evident on one chromatogram, report the result from the other column or clean up the extract; narrate the coelution, and the fact that the lower result was reported, on the "Data Review Checklist".

b. If no coelution is evident, report the higher of the two results.

c. LIMS will apply a 'C'-flag to the reported result.

6.4) If the concentration of any analyte in the sample exceeds that of the highest concentration standard used in the ICAL curve for that compound, dilute the extract and reanalyze. See the "Dilutions" section below for further details.

7.) Dilutions

The UV-DAD detector is a relatively selective detector, which means that although it can detect low levels of NAN or Polynuclear Aromatic Hydrocarbons in sample extracts, there may also be matrix effects upon the system that are not apparent in the sample chromatogram. If the extract is dark, oily & viscous, or opaque, make a dilution that will result in an extract that is a very light yellow in color. If black, oily, or viscous extracts are analyzed, back-pressure may cause the instrument to shut down. See Appendix_3 for preparing various dilutions.

Combine the results from the undiluted run dilution with the results of the dilution whenever possible, providing the lowest possible reporting limits for each compound while ensuring that matrix interferences don't contribute a high bias through coelution or a false negative through analyte-masking.

If a sample is analyzed at multiple dilutions, compare the sample results across the various dilutions to verify that the dilutions were prepared correctly. Do the results make sense or is there a discrepancy between the runs? If there seems to be a discrepancy, reanalyze the sample to confirm the results.

8.) Surrogates

Surrogates are compounds that are chemically similar to the target analytes but are not found in actual samples. These compounds are added, prior to extraction, to every sample, method blank, and spike to monitor the efficiency of the extraction for that sample. In-house Surrogate Acceptance Criteria are specified in the associated SOP '*8330 Laboratory Control Limits, Table-1*'. These limits are generated semi-annually, using control charts.

The LIMS user report will list the surrogate criteria applicable for that sample and will flag any failing recoveries. Evaluate the surrogate recoveries for all samples, method blanks, and spikes on both columns. If the extract was diluted by a factor of 10 or more, the surrogate is considered diluted out and LIMS will place a "DO" flag on the user report and final forms.

If a surrogate recovery is outside QC limits, verify that the prep information (LIMS S#, amount, and concentration of surrogate added, sample weight/ volume, extract volume, and instrument dilution factors) is correct. If any of these are incorrect, fix the entry and reprocess the data.

If the prep entry was correct, use the following guidelines to determine whether reanalysis and/or re-extraction are required:

a. If a high recovery is observed but no target analytes were detected above the reporting limit, report the data without reanalysis, since the possible high bias will not affect sample results.

b. If a high recovery is observed and there is obvious coelution of non-target analytes with the surrogate, report the data without reanalysis. Narrate the failure as due to matrix interference.

c. If a high recovery is observed and target analytes were detected, but there is no obvious chromatographic interference, reanalyze the extract.

   A high surrogate recovery on one column and a surrogate passing acceptance criteria on the other column may be an indication of co-eluting interferences.

   If reanalysis confirms the failure, initiate a Corrective Action Report and have the sample re-extracted. If the same surrogate fails criteria after re-extraction, report whichever analysis has better recoveries and narrate the failure as confirmed matrix interference. Include both sets of data in the package and note the situation in the case narrative.

d. If a low recovery is observed for any surrogate and there is no obvious chromatographic interference or documented historical site matrix interference, reanalyze the extract.

If the same surrogate(s) fails criteria upon reanalysis, initiate a Corrective Action Report and have the sample re-extracted. If the same surrogate fails criteria after re-extraction, report whichever analysis has better recoveries and narrate the failure as confirmed matrix interference. Include both sets of data in the package and note the situation in the case narrative.

Note: If a sample must be re-extracted and the holding time has expired, ask the client's Project Manager to log the sample into LIMS as an "alias" and have the sample re-extracted as the new sample number. If the sample is still within holding time, the sample should be re-extracted under the original sample number.

9.) BATCH QC RESULTS

For every batch of 20 samples (or less) analyzed, a Method Blank (MB), a Laboratory Control Sample (LCS), a matrix spike (MS) and duplicate (MSD) are extracted and analyzed. If insufficient sample volume was submitted for matrix QC, a blank spike (BS) and blank spike duplicate (BSD) are extracted in place of the LCS/ MS/ MSD.

Note: Project-specific quality assurance project plans (QAPPs) may contain different requirements than those listed in this SOP. If so, the QAPP requirements supersede this SOP for all samples related to that project.

9.1) Method blank (MB):

A method blank is extracted with each batch of samples to verify that the extraction reagents and process are not contributing to the sample results. No compounds should be detected in the method blank at levels greater than ½ the reporting limit, however if a compound(s) is detected, reanalyze the method blank to confirm that the extract is contaminated and that the results are not due to instrument contamination.

If the contamination is confirmed by reanalysis, initiate a Corrective Action Record (CAR) use the following guidelines to determine what corrective action is required:

a. If the concentration of the contaminant is below the reporting limit but above 1/2 of the reporting limit, report the data without further corrective action; narrate the contamination on the Data Review Checklist.

b. If the target compound(s) found in the method blank was not detected in the associated samples, report the data without further corrective action; narrate the contamination on the Data Review Checklist.

c. If the same target compound(s) were found in both the method blank and in the associated samples, but the level in the samples is greater than 20x the level in the method blank, report the data without re-extraction.

d. If the same target compounds were detected in the method blank and in the associated samples, but were present in the samples at levels less than 20x the level in the method blank, the samples containing the contaminant must be re-extracted.

Note: For projects associated with the DoD QSM (USACE, Navy, AFCEE), if target analytes are detected at >1/2 RL in the blank and samples, the samples must be re-extracted.

9.2) Laboratory Control Sample (LCS) or Blank Spike/ Blank Spike Duplicate (BS/BSD):
Laboratory Control Samples are extracted with each batch of samples to demonstrate the performance of the extraction and analysis in the absence of matrix interferences. In-house Acceptance Criteria are specified in the associated SOP '*8330 Laboratory Control Limits, Table-1*'. These limits are generated semi-annually, using control charts.

After the batch QC has been run, determine if the LCS passed acceptance criteria for all of the client-specified limits associated with each job in the batch:

1.) Go to the HPLC Page within the LIMS Intranet

2.) Enter the batch number, job number with its product and matrix in the correct fields

3.) Click on "View" QC status for batch and check the results.

If any of the target compounds fail acceptance criteria, reanalyze the QC extracts. If the failure is confirmed upon reanalysis, initiate a Corrective Action Record and use the following criteria to determine the required corrective action:

a. If the samples are being analyzed for only a subset of the target compound list (ie: HMX & RDX only, or similar) and those compounds all pass acceptance criteria, the data may be reported without further corrective action.

b. If a high recovery is observed but that compound was not detected in the associated samples, note the failure on the Data Review Checklist and report the data without re-extraction, as the potential high bias does not affect the sample results.

c. If a high recovery is observed and the samples contain target compounds at levels above the reporting limits, the samples containing that compound must be re-extracted.

d. If a high RPD is observed but the recoveries are within acceptance limits and the samples do not contain that compound, note the failure on the Data Review

Checklist and report the data without re-extraction, as the lack of good precision data does not affect ND samples.

e. If a high RPD is observed and the samples contain that compound at levels above the reporting limits, those samples containing that compound must be re-extracted.

f. If a low recovery is observed for any spike compound, the associated samples must be re-extracted.

If a sample must be re-extracted and the holding time has expired, ask the client's Project Manager to log the sample in as an alias and have the samples re-extracted as the new sample number. If the sample is still within holding time, re-extract and reanalyze the sample under the original sample number.

9.3) Matrix Spike/ Matrix Spike Duplicate (MS/MSD):

Matrix spikes are extracted with each batch of samples to demonstrate the accuracy (recovery) and precision (RPD) of the analysis in real-world samples. In-house Acceptance Criteria are specified in the associated SOP '*8330 Laboratory Control Limits, Table-1*'. These limits are generated semi-annually, using control charts.

Review the MS/MSD data. If either the recoveries or RPD fail criteria, determine whether or not the data can be reported based on the following:

a. If the concentration of a target compound in the sample is greater than the linear range and the sample needs to be rerun for just that compound, report the MS/MSD with a LIMS-flag of ">LR" on those recoveries without reanalysis.

b. If the concentration of a target compound in the sample is within linear range but the concentration in the matrix spikes is greater than the linear range, LIMS will apply a ">LR" flag to those recoveries. Report the data without reanalysis.

c. If the concentration of a target compound is greater than 4x the spiking level, LIMS will apply a "NM" (for "Not Meaningful") flag to those recoveries. Report the data without reanalysis.

   Note: For USACE projects, if the concentration of a target compound is greater than the spiking level, LIMS will flag and footnote that concentration for the client's attention.

d. If recoveries fail but the RPD is within acceptance limits, matrix interference is usually suspected. Narrate the failure and report the data without reanalysis (except for USACE, or other Level 3 or Level 4 projects that always require reanalysis).

e. If the recoveries fail due to obvious chromatographic interference (ie: coelution of other analytes with the spike compounds), narrate the failure on the Data Review Checklist and report the data without reanalysis.

f. If the recoveries are within limits but the RPD fails, and an isolated problem cannot be identified and documented, reanalyze the sample and matrix spikes.

Electronically sign each LIMS file after you have confirmed that the data is correct and reportable. After all batch QC samples have been reviewed and deemed acceptable, complete a Batch Review Checklist and inform the QC Chemists, Group Leader, or Department Manager and have the data second-party reviewed.

DOCUMENTATION & PEER REVIEW

All data must be reviewed by a second party (QC Chemist, Group Leader, or Department Manager) prior to reporting. See Appendix_11 for instructions on working up data in the LIMS paperless system. After all of the chromatograms, user reports, and final forms have been reviewed, and the data file signed by the analyst in the LIMS "Review APP", assemble the data package. This data package should include:

Data Package Review Checklist
Job Sheet
Final forms on "page 2" letterhead (for samples & batch QC)

The peer reviewer must initial and date each user report, make any additional comments on the case narrative, generate Level-3, Level-4, or client-specific reports then sign off on the completed checklist before turning it in to the front office.

POLLUTION PREVENTION

Prepare only sufficient standard and reagent volumes to use within the shelf-life of the standard to reduce the volume of waste generated by the laboratory.

WASTE DISPOSAL

Reagent Waste: The methanol/water solvent is collected in a waste container and is then transferred to the 'Mixed Solvent' (WMDS# 628206) drum in the flammables cabinet located in the waste room.

Extracts: The autosampler vials are stored in the refrigerator at 4°C (± 2°C) for at least 40 days after extraction. The vials are then transferred to a lidded storage bucket until the bucket is full. Vials are then transferred to the 'Solvent/ Solid' waste (WMDS# 858491) open-head drum in the waste room.

APPENDIX_1: CALCULATIONS

If the analyst wants to verify that LIMS or Chemstation is performing calculations correctly, use the Excel spreadsheet F:\qc\validation\HPLC_Calculations.xls. Enter the spike/standard concentrations, Chemstation areas, and any applicable prep or instrument dilution factors then compare the spreadsheet result to that produced by LIMS or Chemstation. This verification is performed annually by the QA/QC department and is not required by the analyst, but may be performed at the analyst's discretion.

SAMPLE RESULTS

Moisture Corrected ('Dry Weight') Results

If a client requests results reported on a 'Dry Weight' basis, the concentration is divided by the 'solids', where the solids is (100-%moisture)/100.

Dry Weight Concentration (ug/Kg) = "As Received" Conc. / ((100 - %moisture)/100)

Concentration using Average Calibration Factor (by external standard)

$$Cx = (Ax / CFavg) * pdf * idf$$

Where: Ax = Area of compound
CFavg = Average Calibration Factor from the curve
pdf = Prep Dilution Factor (Vf/Vi or Vf/Wi), for P&T D =1, dimensionless
idf = Instrument Dilution Factor

Concentration using Linear Regression (by external standard)

$$Cx = [(Ax – b) / m] * pdf * idf$$

Where: Ax = Area of compound
b = intercept
m = slope
pdf = Prep Dilution Factor (Vf/Vi or Vf/Wi), for P&T D =1, dimensionless

BATCH QC RESULTS

Percent Recovery:
The recovery is the measured concentration divided by the true concentration of the spike.

%Recovery = (Cf – Cs) / (Cws * Vws) *100

Where: Cf = final measured concentration in the spiked sample
Cs = measured concentration in the un-spiked aliquot of sample
Cws = concentration of the spiking standard
Vws = volume used, of the spiking standard

Relative Percent Difference (RPD):
The RPD is the absolute value of the difference in concentrations divided by the average of the concentrations.

%RPD = |(Cs - Cdup)| / ((Cs + Cdup)/2) * 100

Where: Cs = measured sample concentration
Cdup = measured concentration in the duplicate

CALIBRATION

Calibration Factor (CF) using External Standard
"Calibration Factor" is the ratio of the detector response (area) to the amount (mass or concentration) in the calibration standard.

CF = Ax / Cx

Where: Ax = Area of the compound
Cx = Concentration of the compound

Average Calibration Factor (CFavg):

Average CF = CFavg = ∑(CFi) / n

Where: CFi = Calibration factor for each level
n = number of calibration points

Standard Deviation

$$SD = \sqrt{\{[\sum (CFi - CFavg)^2] / (n-1)\}}$$

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Where: CFi = Calibration factor for each level
CFavg = Average Calibration Factor
n = number of calibration points

Relative Standard Deviation

$$RSD = (SD / CFavg) * 100$$

Where: SD = Standard Deviation
CFavg = Average Calibration Factor

Linear Regression Equations

$$y = mx + b$$

Where: y = response (Ax for external standard = Area of compound)
x = concentration (Cx for external standard)
m = slope
b = intercept

Slope (m) = $[(\sum wx_iy_i * \sum w) – (\sum wx_i * \sum wy_i)] / [(\sum w * \sum wx_i^2) – (\sum wx_i * \sum wx_i)]$

Intercept (b) = $y_{avg} – (m * x_{avg})$

Correlation Coefficient (r)

$$r = \frac{[(\sum w * \sum wx_iy_i) – (\sum wx_i * \sum wy_i)]}{\sqrt{\{[(\sum w * \sum wx_i^2) – (\sum wx * \sum wx_i)] * [(\sum w * \sum wy_i^2) – (\sum wy_i * \sum wy_i)]\}}}$$

Coefficient of Determination (r^2) = r * r

Where: x_i = individual values for the independent variable (concentration)
y_i = individual values for the dependent variable (response, area)
w = weighting factor (for no weighting w = 1)
x_{avg} = average of the x-values
y_{avg} = average of the x-values

CALIBRATION VERIFICATION

Percent Recovery:
The recovery is the measured concentration divided by the true concentration of the spike.

%Recovery = (Cf – Cs) / (Cws * Vws) *100

Where: Cf = final measured concentration in the spiked sample
Cs = measured concentration in the un-spiked aliquot of sample
Cws = concentration of the spiking standard
Vws = volume used, of the spiking standard

Percent Difference (%D):
For calibration verification standards, the %D is the difference between the true concentration of the standard and the calculated concentration of the standard, divided by the true concentration, multiplied by 100:

%D (Percent Difference) = ((Cws - Cf) / Cws) * 100

Where: Cws = true concentration of the spiking standard
Cf = final measured concentration in the spiked sample

%Drift used also for calibrations based on true vs calculated values

%D (% Drift) = ((C1 - C2) / C1) * 100

Where: C1 = Concentration of the Calibration Verification Standard
C2 = Measured concentration

APPENDIX_2: STANDARDS & REAGENTS

The reagents and standards listed below are those that were in effect when this procedure was written. Supplies may be purchased from alternate vendors or prepared at different levels, so long as they are fully documented and traceable.

SOURCE STANDARDS

Source standards are those purchased directly from a chemical manufacturer or vendor. The LIMS S-name is unique to the manufacturer of the source standard; if a source standard is obtained from a different manufacturer, a new S-name must be assigned and the information entered in the "Standard Definitions" table before the standard can be assigned an S#.

Source standards usually have an expiration date set by the manufacturer. If no expiration date is listed, the expiration date is one year from date received. Certificates of Analysis should be obtained from the vendor of each source standard; the certificates should be labeled with the LIMS ID and the date received and filed in the 3-ring binder.

Enter all source standards into LIMS immediately upon receipt, using the Standards Menu "Standard Inventory", listing the date received, lot number, and expiration date. Write the LIMS S# on the vials and the certificate of analysis.

The standards listed below were those in use at the time this document was written; however standards may be purchased from different vendors so long as they are traceable through LIMS and the Standards Prep Logs.

Store the standards at 4°C ($\pm$ 2°C) in refrigerator # 21; do not store standards in a refrigerator containing samples or extracts.

Primary Source Standards

Analytes	Concentration (ug/mL)	Supplier & Catalog#	LIMS S- Name
8330 Calibration Mix # 1	1,000	Restek 31450	8330_CAL1
8330 Calibration Mix # 2	1,000	Restek 31451	8330_CAL2
8330 Surrogate Mix (1,2-Dinitrobenzene)	1,000	Restek 31453	8330_SURR

Secondary (ICV) Source Standards

Analytes	Concentration (ug/mL)	Supplier & Catalog#	LIMS S- Name
EPA 8330 MIX A	100	Supelco 4-7283	8330 MIX A
EPA 8330 MIX B	100	Supelco 4-7284	8330 MIX B

WORKING STANDARDS

Working standards are those prepared by C&T. For working standards, the LIMS S-name is not necessarily unique to the source standard used to create the working standard but *is* unique to the compound list and concentrations contained in the working standard; if the concentration or compounds in the working standard changes, a new S-name, compound list and concentrations must be entered in the "Standard Definitions" table before the standard can be logged in and assigned an S#. It is *very important* to enter this information correctly, as LIMS uses this information to calculate spike and surrogate recoveries.

Prepare working, or secondary, standards by diluting the source standard solutions in 50%:50% (v:v) acetonitrile:water.

Method Modification Note: Method 8330 calls for the calibration standards associated with water samples to be prepared in methanol, however C&T uses Solid Phase Extraction (SPE) method 3535 for extraction of water samples with acetonitrile as the final solvent. This also eliminates the need to dilute the samples and extracts with $CaCl_2$ solution and enables C&T to combine extracts from either matrix in the same analytical sequence.

Verify that the LIMS expiration date of the working standard does not exceed that of any of the source or intermediate standards used to make it. If any of the source standards expire before the 30 days (8330 section 5.4.2), change the expiration date of the working standard to match the earliest expiration date of the stock standards. **The expiration date of the working standard *must not* exceed the expiration date of any of the source standards from which it was made.**

In the Standards Benchbook, enter the prep date, LIMS S#, concentration, and volume of each source standard used, solvent name and lot#, the LIMS S-name and concentration of the working standard, expiration date, and prep chemist's initials.

In LIMS, use the "Standards Inventory" screen to enter the prep chemist's initials, prep date, and S# of the source or intermediate standards used to make the working standard; LIMS will then assign a standard number (S#).

Label the standards vials with the name & concentration (or calibration level) of the standard, LIMS S# and the expiration date. Store these standards at 4°C (± 2°C) in Refrigerator #21 in the hallway; do not store standards in a refrigerator containing samples or extracts.

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8330 STANDARDS PREP TABLE

WS Standard & Conc. (µg/mL)	Final Volume (mL) in 1:1 Acetonitrile:H_2O	Using Standard	Add Vol (mL) Standard	LIMS S- Name
NAN at 10 ug/mL	10	8330_CAL1	0.10	NAN_10
		8330_CAL2	0.10	
		8330_SURR	0.25	
NAN at 5 ug/mL	10	7_8330	5.00	NAN_5
NAN at 2 ug/mL	10	6_8330	4.00	NAN_2
NAN at 1 ug/mL	10	7_8330	1.00	NAN_1
NAN at 0.5 ug/mL	10	6_8330	1.00	NAN_0.5
NAN at 0.1 ug/mL	10	4_8330	1.00	NAN_0.1
NAN at 0.02 ug/mL	10	2_8330	2.00	NAN_0.02
NAN ICV at 1 ug/mL	10	8330 MIX A	0.10	NAN_ICV
		8330 MIX B	0.10	
		8330_SURR	0.025	

REAGENTS

For any reagents that are not used directly from the bottle but are prepared by a chemist, the preparation of all reagents, including dilutions into Millipore DI water, must be documented in the reagent prep benchbook. Each reagent must be assigned a unique ID, based on the manufacturer and the date prepared.

Acetonitrile, EMD Omnisolve, VWR Catalog# AX0142-1
Store at room temperature in a Flammables cabinet for up to 6 months.

Methanol, EM Science, EMD Omni-Solv grade, VWR Cat# MX0488-1
Store at room temperature for up to 1 year.

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APPENDIX_3: 8330 DILUTIONS

Dilutions should be prepared from the initial 1:1 dilution in acetonitrile/water and diluted with additional 1:1, so that the solvent ratios are consistent throughout all sample extracts and standards. Let the extracts warm to room temperature then prepare the dilution in acetonitrile, in either an autosampler vial or an insert. See table below for appropriate volumes. Shake the dilution and invert 3 times to mix.

Dilution Factor	Made In	Extract Volume (µL)	Acetonitrile:Water Volume (µL)
2x	Insert	100	100
	GC vial	500	500
3x	Insert	50	100
	GC vial	250	500
4x	Insert	50	150
	GC vial	250	750
5x	Insert	40	160
	GC vial	200	800
10x	Insert	20	180
	GC vial	100	900
20x	Insert	10	190
	GC vial	50	950
50x	GC vial	20	980
100x	GC vial	10	990

SERIAL DILUTIONS
If you need to make a >100x dilution, first make the 100x dilution listed above, then make further dilutions, using that as an intermediate.

Dilution Factor	Using Primary Dil'n	Made In	Extract Volume (µL)	Acetonitrile:Water Volume (µL)
200	100x	GC vial	100	100
500	100x	GC vial	40	160
1,000	100x	GC vial	20	180

APPENDIX_4: INSTRUMENT CONDITIONS

Column Commentary

EPA Method 8330A requires two column, one column for presumptive identification of target compounds (example: LC-18, reverse phase) and a second column for the confirmation of target compounds (example: LCCN, reverse phase), which changes the elution order of target compounds.

The LC-18 column can be used for elution and separation of the target compounds under such conditions as ambient temperature or 35°C and up to 100 µL injections without showing column overload and excessive adjacent peak coelution. Each target compound has an optimum wavelength for detection however EPA Methods 8330 and 8330A require use of the 254 nm signal; method 8330B discusses the use of dual wavelengths at 254 nm & 210 nm.

The LC-CN column literature and specifications give optimum elution and separation of target compounds under sub-ambient column temperatures and injection volumes of 3 – 5 µL. In method 8330, the three target compounds 2-NT, 3-NT, and 4-NT are frequently not resolved from the carrier peak into individual analyte peaks. The quantitation for this composite peak using the LC-CN column will be the sum of the quantitation for these three target compounds using the LC-18 column. Also, the two target compounds 2-Amino-4,6-dinitrotoluene and 4-Amino-2,6-dinitrotoluene are frequently not resolved into individual peaks. The quantitation for this composite peak using the LC-CN column will be the sum of the quantitation for these two target compounds using the LC-18 column. The LC-CN column may be used for target compound confirmation when only a few target compounds are detected using another column.

The ABZ+PLUS amide column is used as a second column. The ABZ+PLUS amide column gives good separation of all target compounds at 35°C column temperature with up to a 50 µL injection while satisfying the method requirement for causing a substantial change in the target compound elution order compared to the other column in use.

Sample extracts that are ND for all target compounds screened with one column are not re-analyzed using the second column. There is no inherent reason for preferring either the LC-18 column or the ABZ+PLUS amide column for initial screening.

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Instrument Conditions

The instrument conditions listed below are typical for this analysis but may be changed at the analysts' discretion to improve instrument performance. Refer to Instrument Maintenance Log for current parameters.

LC-18 Column

25cm x 4.6 mm ID, 5 micron SUPELCOSIL, Supelco Cat. # 58298

Control	Column	1.10	mL/min
	Stop time	38.0	min
	Post time	7.0	min
Solvents	Solvent A	65.0%	Water
	Solvent C	35.0%	MeOH
Pressure	Minimum	0	bar
	Maximum	400	bar
Auxiliary	Max Flow	100	mL/min^2
	Compress.	$100*10^{-6}$	bar

Time Table	Time (min)	%Bottle A (Water)	%Bottle C (MeOH)
	0.0	65	35
	20.0	65	35
	30.0	55	45
	35.0	55	45
	35.01	65	35

Diode Array	Signal	Wavelength (nm)	Bw
	A	254	4
	B	254	16
	C	210	8
	D	230	16
	E	280	16

Peak width	> 0.1	min
Slit	4	nm

Fluorescence Detector

Peak width	> 0.2	nm
PMT Gain	10	
Excitation Range	220 – 380	nm
Emission Range	300 - 500	nm

Oven Temperature 33 °C

ABZ+PLUS Amide Column

25cm x 4.6mm ID, 5 micron SUPELCOSIL, Supelco Cat. # 59197

Control	Column	0.70	mL/min
	Stop time	34.0	min
	Post time	6.0	min
Solvents	Solvent A	65.0%	Water
	Solvent C	35.0%	MeOH
Pressure	Minimum	0	bar
	Maximum	400	bar
Auxiliary	Max Flow	100	mL/min^2
	Compress.	$100*10^{-6}$	bar

Time Table	Time (min)	%Bottle A (Water)	%Bottle C (MeOH)
	0.0	65	35
	11.5	65	35
	12.5	50	50
	30.0	50	50
	30.01	65	35

Diode Array	Signal	Wavelength (nm)	Bw
	A	254	4
	B	254	16
	C	210	8
	D	230	16
	E	280	16

Peak width	> 0.1	min
Slit	4	nm

Fluorescence Detector

Peak width	> 0.2	nm
PMT Gain	10	
Excitation Range	220 – 380	nm
Emission Range	300 - 500	nm

Oven Temperature 35 °C

Instrument Start Up:

1) Fill the solvent reservoir bottles.
2) Empty the solvent waste container into the appropriate waste stream.
3) From the Chemstation Online session, select Instrument > System On.
4) Load the method to be used, if not already loaded.
5) Select File > Load > Method.
6) From the list of methods displayed, select the method to be loaded and click OK.
7) Allow approximately 30 minutes, before starting the sequence, to allow the lamps to warm up and stabilize.
8) If the HPLC has not been used for several days, make a trial CCV injection and check to see that each target analyte falls within its retention time window. If it does not, make one or two more injections to prime the system. When all of the target analytes fall within their respective RT windows and have been correctly identified by the system, load extracts and start the sequence.
9) See Appendix_10 for instructions on writing and using Chemstation sequences.

Instrument Shut-Down:

After the sequence has finished running, a macro-program will automatically shut off the HPLC.

APPENDIX_5: MAINTENANCE & TROUBLE-SHOOTING

Any maintenance performed on the instrument (ie: MeOH or DI water added to reservoir, changed column, changed conditions) must be documented in the Maintenance Benchbook. Each entry should include:

- reason the maintenance was necessary (‘CCV failing’, etc.),
- the date and analyst initials,
- maintenance steps performed (‘cleaned detector’), and
- resolution (‘ICAL passed’, etc.) of the maintenance.

If maintenance is performed by an outside contractor, the contractor should provide documentation of what steps were taken and any parts replaced. This certificate or receipt should be kept on file in the 3-ring binder labeled ‘Vendor Maintenance Receipts’.

Adding Solvent to the Reservoirs:
The water and Methanol solvent reservoirs can be refilled while the HPLC is in operation. Make sure that the solvent level when the bottle is dropped is above the pump intake then drop the solvent bottle (pull the lever to release the solvent bottle clamp). Fill a 100 mL volumetric flask with solvent (which has been purged with Helium on another HPLC) and add this to the solvent reservoir; repeat as necessary. If the new solvents have not been purged, pause the sequence and purge the new solvent for 15 min at a Helium pressure of 40 psi. Then turn the He pressure down to 8 psi for the remainder of the sequence.

Conditioning the System after Idle/Standby:
If the HPLC system has not been in use for a few days, the system should be conditioned with one or two injections of the high Nitroaromatics and Nitramines standard before starting a sequence. Use an outdated or previously injected standard for conditioning.

Instrument "Not Ready"
Under normal operating conditions this light may be lit when the Oven Temp is either higher or lower than the preset temperature.

Retention Time Drift:
If the compounds are eluting in a much shorter time than expected and the RT's drift up with each run, the HPLC column may not be equilibrated with water. Equilibrate by flushing the column with 50/50% H_2O/Methanol for two to three hours. Set the column oven temperature to 40 or 45°C to speed the equilibration then analyze two solvent blanks and two CCV's to determine if this has solved the problem. Remember to reset the column oven temperature to the correct initial temperature!

APPENDIX_6: C&T COMPOUND LIST & REPORTING LIMITS

Some sources may use differing nomenclature or abbreviations for target compounds. Two sets of abbreviations are given in the table, those often found on compound lists and those used in electronic databases and deliverables (valid values). Target compounds are uniquely identified by the CAS#, and it can be used to eliminate possible confusion about compound names and abbreviations.

CAS #	Target Compound	Common Abbreviation	LIMS Abbreviation
2691-41-0	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	HMX
121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	RDX
99-35-4	1,3,5-Trinitrobenzene	1,3,5-TNB	TNB135
99-65-0	1,3-Dinitrobenzene	1,3-DNB	DNBZ13
98-95-3	Nitrobenzene	NB	NO2BZ
479-45-8	Methyl-2,4,6-trinitrophenylnitramine	Tetryl	TETRYL
118-96-7	2,4,6-trinitrotoluene	2,4,6-TNT	TNT
35572-78-2	2-Amino-4,6-dinitrotoluene	2-Am-DNT	A2DNT46
1946-51-0	4-Amino-2,6-dinitrotoluene	4-Am-DNT	A4DNT26
121-14-2	2,4-Dinitrotoluene	2,4-DNT	DNT24
606-20-2	2,6-Dinitotoluene	2,6-DNT	DNT26
88-72-2	2-Nitrotoluene	2-NT	NBZME2
99-99-0	4-Nitrotoluene	4-NT	NBZME4
99-08-1	3-Nitrotoluene	3-NT	NBZME3

CAS #	Target Compound	Water RL (µg/L)	Soil RL (µg/Kg)
2691-41-0	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	0.5	100
121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine	0.5	100
99-35-4	1,3,5-Trinitrobenzene	0.5	100
99-65-0	1,3-Dinitrobenzene	0.5	100
98-95-3	Nitrobenzene	0.5	100
479-45-8	Methyl-2,4,6-trinitrophenylnitramine	0.5	100
118-96-7	2,4,6-trinitrotoluene	0.5	100
35572-78-2	2-Amino-4,6-dinitrotoluene	0.5	100
1946-51-0	4-Amino-2,6-dinitrotoluene	0.5	100
121-14-2	2,4-Dinitrotoluene	0.5	100
606-20-2	2,6-Dinitotoluene	0.5	100
88-72-2	2-Nitrotoluene	0.5	200
99-99-0	4-Nitrotoluene	0.5	200
99-08-1	3-Nitrotoluene	0.5	200
	Surrogate		
528-29-0	1,2-Dinitrobenzene		

The compound list and reporting limits listed above are C&T standard lists, which may be modified to meet client- or project-specific requirements. Standard reporting limits are based on:

Matrix	Sample Wt or Vol	Final Extract Volume	Injection Volume (ABZ-Plus Column)	Injection Volume (LC-18 Column)
Water	1,000 mL	5 mL	50 µL	100 µL
Soil	5 g	10 mL	50 µL	100 µL

APPENDIX_7: RETENTION TIMES & ELUTION ORDER

Retention Time (RT) Windows:
"RT Windows" are necessary because compounds may not elute at *exactly* the same time during each and every injection, due to slight variations in temperature, flow rate, or injection composition (sample viscosity, compound concentrations), etc. The RT-window is the length of time (width, in minutes, on the chromatogram) during which any peak eluting within the window is presumed to be the analyte of interest. "72-hour Study" is a term often used by auditors to describe statistical analysis of the retention times of standards injected over a 72 hour sequence; theoretically, the RT windows determined by this study can be used for routine analysis, however the studies that C&T has conducted in the past result in windows that are too narrow for routine use. C&T therefore uses the default retention time windows of $\pm$ 0.03 minutes as specified in EPA 8000B.

If a 72-hour RT study is required by a client or auditor, the RT windows are defined as plus or minus three times the standard deviation of the absolute retention times for each compound in the calibration standard mix as measured over the course of 72 hours. (*Note:* This procedure has historically (and consistently) produced rt-windows too tight for routine use.) In the event that a standard deviation is 0.00, then use the 0.03-minute window (see 8000B). However the experience of the analyst should weigh heavily in the interpretation of the chromatograms.

Absolute Retention Times:
The "absolute" retention time of any compound is the expected time of the compound is the center of the RT window. Use the retention time for each analyte from calibration standard injected during that 12 hour shift as the "absolute" retention time. Use the calibration standards analyzed during the sequence to evaluate retention time stability. If any of the standards fall outside their daily or preset fixed retention time windows, the system is out of control. Determine the cause of the problem and correct it.

Method Modification Note: EPA 8000B, Section 7.6.5 suggests updating the absolute retention times each time a new sequence is started. Because the retention times for these compounds are relatively stable, C&T has found it necessary to update the retention times only when performing the initial calibration.

Elution Order:
The order in which compounds elute is based on chemical composition of the stationary phase of the column and on the instrument conditions (flow rates, temperature programming, column length). Given a specific set of instrument conditions (flow rates, temperature program) the order in which compounds elute from a column should remain constant but may differ between different types of columns. See the table below for the expected elution order of the single-component analytes on columns LC-18 and ABZ+PLUS Amide.

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ELUTION ORDER
For EPA 8330
Nitroaromatics & Nitramines

LC-18 Column	ABZ+PLUS Amide Column
HMX	HMX
RDX	1,3,5-Trinitrobenzene
1,3,5-Trinitrobenzene	RDX
1,2-Dinitrobenzene (surrogate)	1,3-Dinitrobenzene
1,3-Dinitrobenzene	1,2-Dinitrobenzene (surrogate)
Nitrobenzene	Nitrobenzene
Tetryl	TNT
TNT	Tetryl
2-Am-DNT	2,6-Dinitotoluene
4-Am-DNT	2,4-Dinitotoluene
2,4-Dinitrotoluene	2-Nitrotoluene
2,6-Dinitotoluene	4-Nitrotoluene
2-Nitrotoluene	3-Nitrotoluene
4-Nitrotoluene	4-Am-DNT
3-Nitrotoluene	2-Am-DNT

APPENDIX_8: **INITIAL CALIBRATION**
Procedure & Acceptance Criteria

REQUIREMENTS

An initial calibration curve must be analyzed whenever instrument conditions (temperature programs, flow rates, columns, etc.) have been changed, or the detector has been cleaned. A new calibration curve should not need to be established if only minor maintenance has been performed (ie: changing a syringe, transfer line or guard column). In general, a new calibration curve must be made whenever instrument conditions have been altered, or whenever the continuing calibration verification no longer passes acceptance criteria.

The instrument analytical range must be established by running a minimum of 5 calibration standards, containing all target compounds, at levels that bracket the quantitation range (see Appendix_2 for standard suppliers); the lowest standard must be at or below the reporting limit and the highest standard determines the upper end of the quantitation range. Unlike most other analyses, the 8330 ICAL standards must be analyzed in random order (EPA Methods 8330 and 8330A, paragraph 7.3.2) of concentration. Points may be dropped so long as the following criteria are met:

- The highest concentration standard may be omitted so as long as there are at least five points remaining and the remaining highest point defines the top of the calibration range (any extracts which exceed this response must be diluted and reanalyzed).

- The lowest concentration standard may be omitted from curve if, *and only if*, the resulting lowest standard is at or below the reporting limit for samples and there are at least five points remaining.

- Mid-point standards may not be omitted simply to improve the RSD or linear correlation coefficient. They may, however, be reanalyzed if a poor injection is suspected. The reanalysis must occur immediately after the curve so long as no sample extracts were analyzed since the last calibration standard and all compounds are calibrated using the second run. Under no circumstances may a point in the middle of the curve be rejected in order to pass calibration criteria for a particular compound.

Use the average calibration factor, omitting the zero point, for each compound to generate the ICAL curve. The percent relative standard deviation (%RSD) of the calibration factors must be $\leq$20% for each analyte or, if using linear regression, the correlation coefficient (r) is 0.995 or greater, the multi-point (5 or more points) curve is acceptable. *Note:* LIMS reports the correlation coefficient as r^2 which must therefore be $\geq$ 0.99.

The curve must be verified by analyzing an Initial Calibration Verification (ICV) standard comprised of standards obtained from a different manufacturer than those used to prepare the ICAL standards. The ICV must meet the CCV %D criteria.

NITROAROMATICS and NITRAMINES Initial Calibration Levels (mg/L)

Compound	NAN_0.02 Level 1	NAN_0.1 Level 2	NAN_0.5 Level 3	NAN_1 Level 4	NAN_2 Level 5	NAN_5 Level 6	NAN_10 Level 7
HMX	0.02	0.10	0.50	1.00	2.00	5.00	10.0
RDX	0.02	0.10	0.50	1.00	2.00	5.00	10.0
1,3,5-Trinitrobenzene	0.02	0.10	0.50	1.00	2.00	5.00	10.0
1,3-Dinitrobenzene	0.02	0.10	0.50	1.00	2.00	5.00	10.0
Nitrobenzene	0.02	0.10	0.50	1.00	2.00	5.00	10.0
Tetryl	0.02	0.10	0.50	1.00	2.00	5.00	10.0
TNT	0.02	0.10	0.50	1.00	2.00	5.00	10.0
2-Am-DNT	0.02	0.10	0.50	1.00	2.00	5.00	10.0
4-Am-DNT	0.02	0.10	0.50	1.00	2.00	5.00	10.0
2,4-Dinitrotoluene	0.02	0.10	0.50	1.00	2.00	5.00	10.0
2,6-Dinitotoluene	0.02	0.10	0.50	1.00	2.00	5.00	10.0
2-Nitrotoluene	(0.02)	0.10	0.50	1.00	2.00	5.00	10.0
4-Nitrotoluene	(0.02)	0.10	0.50	1.00	2.00	5.00	10.0
3-Nitrotoluene	(0.02)	0.10	0.50	1.00	2.00	5.00	10.0
1,2-Dinitrobenzene (surrogate)	0.05	0.25	1.25	2.50	5.00	12.5	25.0

NOTE: Levels listed in parentheses are those below C&T standard report limits.

INITIAL CALIBRATION PROCEDURE

Run the Initial Calibration Standards:

1.) Prepare the standards as described in Appendix_2.

2.) Prepare an Initial Calibration Verification (ICV) standard from source standards obtained from a different manufacturer than the ICAL standards.

3.) Perform any needed instrument maintenance and run an instrument blank. If any target compound is detected above the reporting limit, run another instrument blank.

4.) Load the calibration standards onto the autosampler tray in random order of concentration.

5.) Add instrument blanks before and after the ICAL standards to demonstrate that the low-level standard was not influenced by instrument contamination and that analytes at the high-level concentrations will not carryover into real-world samples.

6.) Load the ICV after the instrument blank that follows the calibration standards. The ICV, prepared from standards obtained from a second manufacturer, must be analyzed to verify that the standards used to create the initial calibration curve were prepared correctly.

7.) Write the sequence as below, identifying the type of sample as initial calibration standards, the LIMS identification of the standards, and the applicable dilution factors. The “stype” and LIMS S-number must be correctly entered into the sequence in a specific order for LIMS to be able to interpret the information and should be written into the sequence as follows:

IB
ICAL, S#, NAN_<level #>
ICAL, S#, NAN_<level #>
ICAL, S#, NAN_<level #>
ICAL, S#, NAN_<level #>
ICAL, S#, NAN_<level #>
ICAL, S#, NAN_<level #>
IB
ICV, S#,

Where:
S# is the LIMS S# of the standard used

8.) Use the same Chemstation method as used for samples (ie: ABZP-<julian date> or LC18-<julian date>).

9.) Make sure the “printing suppressed” box is checked then start the run.

ICAL REVIEW & APPROVAL

Review the Data in Chemstation

10.) Make sure that you have created and entered a new method into the sequence before processing an ICAL. Also make sure the new method is currently open in your Chemstation session.

11.) Process the ICAL runs through Chemstation then examine the data.

12.) Verify that each compound was detected, identified, and integrated correctly in each of the standards.

Peaks should be integrated from baseline to baseline. Manual integrations of any kind must be identified on the Initial Calibration Report and consistently applied to ICAL, ICV, CCV, QC and sample integrations. **Alteration of peak integration solely to pass calibration criteria is illegal and is grounds for immediate termination.** Chemstation will identify any baseline events on the chromatogram (see Appendix_10 for flag definitions). If the reason for the integration is not intuitive and obvious, the analyst <u>must</u> document the reason on the data.

13.) Examine the retention times closely to make sure that the elution order is correct.

14.) Generate and review the Chemstation ICAL summary on screen, verifying that the curve is linear and that the upper levels are not saturated.

15.) Verify that the calibration is useable by reviewing the results against the following criteria:

15.1) The Relative Standard Deviation (RSD) of the Calibration Factors for each compound should be less than or equal to 20%.

15.2) If the average response factors fail to meet the 20% RSD or mean RSD criteria, go to linear regression. If linear regression is used, a minimum of five points is required with a correlation coefficient $r \geq 0.995$. *Note:* LIMS reports the correlation coefficient as r^2 which must therefore be ≥ 0.99.

Quadratic (second-order) regression should not be needed for this analysis, however if a quadratic fit is used, a minimum of six points is required with a coefficient of determination $r^2 \geq 0.990$.

15.3) For each compound:
- The low point may only be rejected for those compounds that have reporting limits equal to or greater than the next level.
- The high point may be rejected for compounds that tend to saturate at high levels so long as there are at least 5 points remaining for each compound in the ICAL.
- If a single point in the curve is causing the failure, the standard may be reanalyzed, so long as it immediately follows the original curve and all compounds are calibrated using the second run. Under no circumstances may a point in the middle of the curve be rejected in order to pass calibration criteria for a particular compound.

15.4) If the curve does not meet these requirements, additional instrument maintenance should be performed and a new curve analyzed.

Process the ICAL in LIMS:
After you've reviewed the data and verified that the calibration passes all acceptance criteria, process the ICAL in LIMS.

16.) Open a web browser and go to the main HPLC.

17.) Under "Recent Sequences", choose the GC and then choose the sequence you want to process.

18.) Check the boxes next to each of your ICAL data files. Click the CREATE CALIBRATION button at the bottom of the screen.

19.) Type a name for the calibration (ex: NAN_051, where 051 was the Julian date).

20.) Click SAVE + PUT INTO USE and return to the sequence.

21.) At the top of the sequence, the newly created calibration should be listed. Click REVIEW to open the Review App for the calibration.

22.) Sign and review each of the runs. See Appendix_11 for guidelines on using the LIMS Review App.

Package the ICAL for Review:

23.) Print the LIMS ICAL summary. Click the calibration name at the top of the sequence. Go to the bottom of the on-screen ICAL summary and click the PRINT button.

24.) Review the LIMS ICAL summary and verify that the data matches the Chemstation report.

Note: Any corrections to the ICAL must be done through Chemstation and then printed to LIMS\\hplc_Chemstation_capture to send the new data to LIMS. A new ICAL must then be created in LIMS. Any data processed with the incorrect ICAL would then need to be reprocessed against the corrected ICAL.

25.) Examine the LIMS ICAL summary. The %D for recalculated concentrations should be within 20% of the true concentration of the standard. If it is not, discuss the problem with the Group Leader or Department Manager to determine an appropriate Corrective Action.

26.) Review the Initial Calibration Verification (ICV) results to verify that the calibration standards were prepared correctly and to highlight any discrepancies between the primary- and second-source standards.

The ICV should meet the CCV criteria of $\leq$ 15%D. As in the verification of RSD for the initial calibration, if the %D for any analyte is >15%, examine the integration. If the first ICV does not meet the acceptance criteria, another ICV standard may be analyzed; "x" out the first ICV and process the data from the second ICV. *Do not* "cherry pick" some compounds from the first ICV and others from the second ICV; if the second ICV is processed and used, all compounds must be taken from the second standard.

Note: The method 8330B requirement for the ICV & CCV %D is $\leq$ 20%, however CA-DPH has not yet recognized 8330B, so C&T must continue to meet the 15%D requirement specified in methods 8330 & 8330A, for any client that does not list 8330B in a project-specific QAPP.

27.) Complete "ICAL Review Checklist" and attach the Chemstation and LIMS calibration summaries. Turn the data in to the Group Leader, Department Manager or QC Chemist for review; the ICAL cannot be used to process final forms through LIMS until it has been reviewed and approved in LIMS.

Note: The initial calibration must be reviewed and 2nd-party approved in LIMS before final sample Form 1's can be printed; any forms printed before the ICAL is marked 'reviewed' will be flagged as draft results.

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APPENDIX _9: CONTINUING CALIBRATION VERIFICATION (CCV)

REQUIREMENTS
A CCV (Continuing Calibration Verification) standard is analyzed at the beginning of each sequence, before any sample or batch QC extracts, to verify that the response of the instrument has not changed significantly and that the curve may still be used to quantitate sample results. Additional CCV's must be run after every 10 samples (or within 12 hours, whichever comes first), and at the end of the analytical sequence. The concentration of the CCV must be varied within the calibration range but should not be analyzed at either extreme (highest or lowest point) of the ICAL curve.

LIMs identifies samples that are associated with the DoD QSM 4.1 requirements, other DoD requirements or commercial clients. It identifies all project specific criteria that are reviewed by the analyst before sample analysis.

For sequences containing samples that are not associated with requirements from DoD QSM 4.1, if the first CCV does not meet the acceptance criteria, another CCV standard should be analyzed. If two CCV's were analyzed, examine the first one against the acceptance criteria; if it fails, "x" out the first CCV, change the second to stype "CCV" and process the data from the second CCV. *Do not* "cherry pick" some compounds from the first CCV and others from the second CCV; if the second CCV is processed and used, all compounds must be taken from the second standard.

For sequences where both DoD QSM 4.1 samples and non-DoD QSM 4.1 samples are analyzed, both sets of CCVs will be run and integrated and both CCVs must pass the DoD QSM 4.1 criteria. If the entire sequence contains DoD QSM 4.1 samples only, then only one CCV will be analyzed.

If the second analysis of the standard also fails to meet these criteria and the analyst suspects that the CCV standard has degraded, a different CCV standard may be analyzed once. If this standard passes, discard the standard that has been degraded. If the different CCV standard also fails, instrument maintenance required and recalibration may be required if major instrument maintenance is performed.

See Appendix_8 for the Initial Calibration procedure and acceptance criteria. See Appendix_1 for calculation of %D and the calibration factor (CF).

ACCEPTANCE CRITERIA
Process the CCV through LIMS then examine the summary form against the following criteria to determine whether the CCV is acceptable:

1.) All compounds must fall within its retention time window and be automatically identified on both columns by the data system.

2.) All compound responses should be within 15% of the initial calibration (%D $\leq$ 15%).

3.) If the %D for an individual compound fails acceptance criteria, data may be reportable based on the following criteria:

a.) If the failing compound is not a target analyte for the associated samples, sample results should be reported without reanalysis.

b.) If the compound fails the %D criterion due to a high response but was not detected above the reporting limit in the associated samples, the sample results may be reported without reanalysis, as the high bias does not affect the sample results.

c.) If the compound fails the %D criterion due to a high response and *was* detected above the reporting limit in any of the associated samples, the samples should be reanalyzed.

d.) If the compound fails the %D criterion due to a low response and *was* detected (even below the reporting limit), the sample should be reanalyzed.

If any of the above criteria are not met, examine the integration to verify that each peak was correctly integrated. Manual integrations must be consistently applied to ICAL, CCV, and sample integrations. If manual integrations are performed, the file should be resent to LIMS so that a new CCV summary form can be generated.

WARNING: **Unsubstantiated alteration of peak integration solely to pass calibration or QC criteria is illegal and is grounds for immediate termination.**

APPENDIX_10: USING CHEMSTATION

Chemstation Nomenclature:

Data files (.D files) contain the information collected from the UV Detector and is written to the network directory G:\HPLC#\DATA\ and are identified by an 8 digit number. The first three digits represent the Julian date and the following five digits identify the data files incrementally, beginning with 00001.

Sequence files (.S files) are written to the network directory F:\HPLC#\SEQUENCE\ and are identified by MMDDYY (ex: March 6, 2000 sequence is 030600.s).

Batch files (.B files) are written to the network directory G:\HPLC#\BATCH\ and are identified by MMDDYY (ex: March 6, 2000 sequence is 030600.b). Batch files with manual integrations will be identified with a "P" prior to the dot (ex: 030600p.b).

Method files (.M files) contain all instrument parameters to acquire data for samples to be analyzed and all integration parameters for identifying and quantitating target compounds. Methods are identified by the particular column in use and the Julian date. Examples are method LC18-315 and method ABZP-317. The first four characters in the method name identify the column in use (LC18 for the LC-18 column and ABZP for the ABZ+PLUS amide column). The three digits following the dash give the Julian date that the method was created.

RT (retention time) updates use the Julian date of the RT update (example: Feb.1 update will be method name LC18-032 for the LC-18 column).

Prepare an HPLC Auto-Injector Sequence on the On-line Session:

From the on-line session,

1) Select *SEQUENCE*.
2) Select *SEQUENCE PARAMETERS*.
3) Enter your initials into the 'Operator Name' field(default is HPL) and the sequence prefix (Julian date) into the prefix field.
4) Click *OK*.
5) Select *SEQUENCE*.
6) Select *SEQUENCE TABLE*.
7) For each extract in the sequence, enter the vial#, sample number, method name, number of injections per vial (1), multiplier (prep dilution factor), and dilution (instrument dilution factor).
8) Enter all of the sequence information then click *OK*.
9) Select *SEQUENCE*.
10) Select *SAVE SEQUENCE AS* and save the sequence with the current date (see *Nomenclature* above).
11) Click *OK.*
12) Select *RUN CONTROLS*.
13) Select *RUN SEQUENCE* to start the auto-sequence.

Updating Absolute Retention Times:

Update the absolute retention time (not RT window) by opening a Chemstation session, then:

1) Select the *DATA ANALYSIS* menu.
2) Select the *CALIBRATION TABLE*.
3) For each compound, type the updated retention time into the box labeled *RT.*
4) When finished, click *OK*.
5) Select *FILE* from the main menu.
6) Select *SAVE AS*, then *METHOD*, and type in the name of the updated analytical method (use the Julian date of the RT update. For example, Feb.1 update will be method name LC18-032.).
7) Type annotation 'RT updated' in the message block along with operator initials and date. Click *OK.*

Peak Integrations (including Manual Integration):
For each peak identified by the data system, a qualifier flag will appear under the 'Type' heading on the user report. The first letter describes the baseline at the start of the peak and the second describes the baseline at the end of the peak. The baseline codes are as follows:

A	Peak integration was aborted.
B	Peak started or stopped on the baseline.
H	Peak started or stopped on a horizontal baseline.
P	Peak started or stopped while the baseline was penetrated.
S	Integrator recognized the peak as a solvent peak.
T	Tangent skim was enabled.
V	Peak started or stopped with a valley dropline.
+	Peak was included as part of a cluster of summed peaks.
M	Peak was manually integrated.
F	Peak was forced by manual integration. If a peak occurs before the manually integrated peak and the end changes because of the manual integration, the peak is classified as forced.
R	A solvent peak has been affected by manual integration, such as tangent skim and is classified as a re-calculated peak.
Fsho	Front shoulder.
Rsho	Rear shoulder.
O	Over-range peak.

Manual integration may be required if there are coeluting peaks or matrix interferences. Use the *Draw Baseline* function to manually integrate any peaks that are incompletely or incorrectly integrated by the data system. If manual integration is performed, the data system will print the new area directly on the chromatogram at a 45° angle, next to the affected peak. If manual integrations are performed, both the original chromatogram and the reprocessed chromatogram must be included in the final data package. If the reason for any manual integration is not obvious and intuitive from the hardcopy chromatograms, further explanation should be provided, accompanied by your initials and the date.

APPENDIX_11: PROCESSING & REVIEWING DATA IN LIMS

Work up a sequence in LIMS.

1. Process sequence in Chemstation, making sure the Chemstation print setup is set to \\LIMS\hplc_chemstation_capture.

2. Open a web browser and go to the main HPLC page.

3. Under "Recent Sequences", choose the instrument and then choose the sequence you want to process.

   Note: The data must be processed through Chemstation and printed to LIMS\\hplc_chemstation_capture before you can process it through LIMS.

4. Check the sequence for any errors. LIMS takes the run information directly from the Chemstation sequence so any data entry error in the Chemstation sequence will affect the data processed by LIMS.

   If you need to make any changes to the sequence, click FIX at the lower right-hand corner of the LIMS sequence. Make the changes and click Update.

   To regenerate a LIMS user report for a specific run, check the box for the run and click PROCESS.

5. Once the sequence information is correct, use the 'Review App' to review the data, as described below.

6. In the top right corner of the browser window, use the "Review" pull down menu and select your sequence (for example: HPLC04/ 12/19/07).

7. Two windows should open. The window on the left shows the main Review App frame (sequence, batch, ICAL) and the other shows the supporting documents (ie: Chemstation raw data reports, scanned prep logs). Clicking on an item in the left-hand frame will bring up the supporting documents for that item.

   Important! You must be logged in with your own initials to process and review sample data! If another analyst has been using the computer, make sure to login under your name.

8. Check each run to ensure it is within the acceptable criteria, adding any necessary comments, and signing the data.

9. Scroll down the left screen and make sure the raw data report matches LIMS, and check for the proper chromatograms.

10. To add a general comment, click the (+) button while the pull down list to the left is set at COMMENT.

A comment box will appear with your initials.

Type your comment into the blank box.

If you want to associate the comment with a certain analyte in the run, you can choose that analyte on the pull down list to the right of the comment box.

If you want to delete the comment, click the (-) button.

If you need to edit a comment you made at an earlier time, click the (E) button.

Other choices under the Comment pull down list will add commonly used comments.

11. Mark data for re-analysis by clicking the ‘RR’ button. Any re-runs that are not because of linear range will require a brief comment as to why the data needs re-analysis. To undo an RR-flag, click the REPORT button.

12. For over linear range or over diluted samples, use the RR button with the rerun dropdown tab selected and type in the dilution factor needed. Finally, use the RX button for any re-extracts.

13. If the run is needed to confirm the results of another run, check the box ‘NEED FOR CONF’.

14. Note that each analyte can only be ‘chosen’ once for a sample or QC. To choose analytes for reporting, check the box under the ‘U’ (“used”) column; checking the box at the left of the

'U' header will choose all analytes for that run.

15. To change the reporting channel, check the channel for the analyte that needs to be changed or switch the whole list by clicking the CHANNEL pull-down list and choosing 'ALL A' or 'ALL L'. Click REFRESH to apply the changes.

16. Sign the data by clicking the SIGN button at the bottom right. Repeat the process with the other runs in your sequence.

Assemble a Batch in LIMS

Batch QC packages can be put together after the extraction lab has scanned in all the sample prep paperwork and all the QC samples (including the MSS and any necessary re-runs) have run and their brackets have been closed off with CCVs.

17. Use the C&T LIMS search function and type in batch number. This will find all data associated with the batch. Use the review apps pull-down menu and select batch number (ie: batch 139060).

18. Log in if necessary.

    Important! You must be logged in with your own initials to process and review sample data! If another analyst has been using the computer, make sure to login under your name.

19. In Review Application mode on left screen, the runs for the QC will appear along with associated ICALs, CCVs, and sequences. The associated CCVs should already be signed. If any are not signed, review and sign them.

20. Click the batch number at top of screen. Scanned documents should appear on right screen. Scroll down and check for any Corrective Action Records (CAR's) associated with the batch or with samples in the batch. Review and update the CAR.

21. Make sure that all extraction lab paperwork has been scanned correctly.

22. Review the sample prep log to make sure volumes, spike, and surrogate amounts are entered correctly in LIMS (data on left screen). Also look for any comments in the comment section, such as "2x surrogate" or "sediment".

23. Click on each QC data file and verify that all QC requirements (clean MB, analyte recovery, surrogate recovery, RPD) are met and that any necessary comments explaining recoveries that are outside of QC limits are present.

24. Check that the LIMS raw data numbers match the Chemstation data.

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25. Sign each QC file, signifying that the data has been reviewed and is reportable or has been narrated if it is not being reported.

26. Verify that the run of the MSS that you are reporting is the same as the one that is linked to the MS/MSD. If the MSS was re-run for any reason, the run that we are reporting may not be linked correctly. If necessary, change the MSS run that is linked to the MS/MSD using the “MSS” link from the sequence where the MS/MSD ran. It must be changed for both the MS and the MSD individually. Be sure to make comments about any MS/MSD recovery or RPD failure.

27. Add any necessary comments to the batch as a whole using the comment tool at the bottom of the screen. For example, this would be where you could explain that the MS/MSD were not run if the MSS was run at a dilution >5x.

28. Finally, click the “Sign” button when the batch QC pack is complete and ready for review.

29. Notify a QC reviewer that it is ready (by instant message, telephone, or in person).

Assemble a Job in LIMS

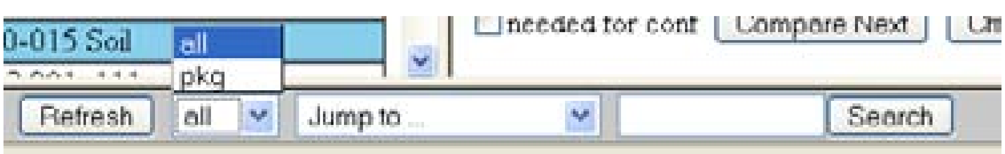
1. Review the job sheet. Check to make sure the QC samples have run and are ready to report. Make sure that any client-specific needs are addressed (for example, CCI needs to be on one instrument). Finally, search for any Corrective Action Reports associated with job and make any comments needed to complete the CAR.

2. Once you know what you need to report, begin by using the C&T search tool and type in job number, bgroup (“hplc”), and matrix (ie: 199721 hplc soil). This will bring up sample data in LIMS. In the top right, use the "Review" pull down menu and select the job you would like to report.

3. Login if necessary.

   Important! You must be logged in with your own initials to process and review sample data! If another analyst has been using the computer, make sure to login under your name.

4. Go to the ‘ALL” mode.



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5. Make sure all of the samples in the job have run and the data is reportable. Sign and review all of the samples in the job and their associated batch QC. Make sure that the analytes you want to report have been 'chosen'.

6. Switch to PKG mode. Click the job number at the top left.

7. Click REPORTS. Check all the relevant samples and QC, then click PRINT to print all of the Form 1's on 2nd -page letterhead paper. Click DONE.

8. You may need to click REFRESH to see the Form-1 information on the Review App.

9. Check the Form-1 for any errors, missing analytes, and draft-flags.

10. Click the Job at the top of the list. Check the comments for any issues that you need to address, like missing signatures and documents.

11. Sign the job. Click CHECKLIST > PRINT to print the review checklist.

12. Complete and sign the checklist. Turn in the checklist and Form-1's to the QC Chemist, Group Leader, or Department Manager for review.

13. Remember to log out by clicking on your initials.

APPENDIX_12: TROUBLESHOOTING HPLC HIGH PRESSURE

The operational pump pressure range for the model 1100 and 1200 series Agilent HPLC is given as 0 - 400 bars.

With stainless steel capillaries and fittings, the HPLC can be operated with the maximum pressure of 400 bars. Due to slight variations in pressure from run to run or a gradual increase of pressure with each successive analysis in a sequence, it is necessary to allow a sufficient margin for a particular method so that the maximum pressure is not exceeded; while the sequence is running. With stainless steel capillaries and fittings an optimum high pressure for a particular method might be 360 bars.

The model 1100 and 1200 series Agilent HPLCs have some capillaries and fittings that are not stainless steel. From practical experience it has been determined that a pressure of 250 bars should not be exceeded, a higher pressure can cause a capillary end to pop loose and cause the HPLC to stop as the result of a leak sensor being activated. It is prudent to allow a sufficient margin for a particular method so that a pressure of 250 bars is not exceeded. The guideline currently in use is to use methods for which the pressure does not exceed 210 bars to allow for gradual pressure increase during a sequence.

The pump pressure for a particular method is dependent on such factors as column length, column diameter, column composition, solvent flow, solvent viscosity, and column temperature.

Other factors that may cause pressure changes included viscous sample extracts, partial blockage of the pre-column filtering frit, blockages or partial blockages in capillaries, problems with various pumps and valves, or an unstable column temperature.

As long as the pressure is stable throughout the entire sequence, an increased pump pressure for a particular method may have little or no consequence as long as the pump pressure does not exceed 250 bars. The major significance, once the column and pre-column filtering frit is ruled out as the source of the pressure increase, is that the HPLC receives preventative maintenance before a major problem develops.

An increased pump pressure must be evaluated both from the standpoint of the HPLC and from the standpoint of the particular method in use.

EPA 8330 Soil Method List

List # : 71665 Account : METHOD_LIST Effective : 15-OCT-2009 Generated : 12/30/09 12:24
Method : EPA 8330 Units : ug/Kg J Flagging : N

Analyte	RL	BS %REC	BSD	MS %REC	MSD	Flags
Nitroguanidine	1000	60-140	20	50-150	30	
HMX	200	81-109	20	68-114	21	
RDX	200	80-114	20	58-111	25	
1,3,5-Trinitrobenzene	200	91-106	20	60-131	18	
1,3-Dinitrobenzene	200	50-142	20	59-138	14	
Nitrobenzene	200	93-108	20	45-160	16	
Tetryl	200	62-108	20	45-114	25	
2,4,6-Trinitrotoluene	200	86-110	20	43-154	15	
2-Amino-4,6-dinitrotoluene	200	73-118	20	73-116	16	
4-Amino-2,6-dinitrotoluene	200	71-114	20	72-113	26	
2,4-Dinitrotoluene	200	85-120	20	49-163	14	
2,6-Dinitrotoluene	200	61-121	20	55-135	23	
2-Nitrotoluene	400	84-107	20	68-124	17	
4-Nitrotoluene	400	86-109	20	67-132	18	
3-Nitrotoluene	400	79-112	20	63-134	19	
1,2-Dinitrobenzene		77-110		77-110		

Curtis & Tompkins Laboratories
MDL Summary for EPA 8330 Soil
As of 11/05/09

Analyte	Units	HPLC04 A	HPLC06 L	HPLC05 A	HPLC05 B	HPLC05 L	HPLC05 M	Highest
Nitroguanidine	ug/Kg				200		41	200
HMX	ug/Kg	15	8.6	27		12		27
RDX	ug/Kg	21	13	40		11		40
1,3,5-Trinitrobenzene	ug/Kg	27	14	35		24		35
1,3-Dinitrobenzene	ug/Kg	4.7	11	20		11		20
Nitrobenzene	ug/Kg	16	19	18		27		27
Tetryl	ug/Kg		25	66		56		66
2,4,6-Trinitrotoluene	ug/Kg	31	19	13		22		31
2-Amino-4,6-dinitrotoluene	ug/Kg	18	63	26		22		63
4-Amino-2,6-dinitrotoluene	ug/Kg	39	55	28		51		55
2,4-Dinitrotoluene	ug/Kg	21	31	20		43		43
2,6-Dinitrotoluene	ug/Kg	22	23	18		50		50
2-Nitrotoluene	ug/Kg	28	17	16		11		28
4-Nitrotoluene	ug/Kg	28	21	31		24		31
3-Nitrotoluene	ug/Kg	40	21	61		18		61

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Sonication Bath Extraction (EPA 8330) of Soil Samples for

EPA 8330

Nitroaromatics & Nitroamines (Explosives)
By HPLC

Approved by:

Department Manager/ Date	QA Director/ Date
Extraction Lab Supervisor/ Date	

Re-approved by:

Extraction Lab Supervisor/ Date	QA Director/ Date

Read & Understood & Approved by:

Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
Signature/ Date	Signature/ Date
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Sonication Bath Extraction of Soil Samples for
EPA 8330 – Nitroaromatics & Nitroamines (Explosives) by HPLC

SCOPE:
This document describes the procedure for the extraction, cleanup, and concentration of selected explosive compounds from solid (soil or sludge) samples by ultrasonic bath extraction. No further concentration step is involved, as the target compounds are very sensitive to heat and should not be exposed to temperatures above normal ambient temperatures.

The reporting limits for this procedure range from 500 µg/Kg for all target analytes execept for Nitrotoluenes, which are at 1,000 µg/Kg.

REFERENCES:
EPA 3500B, Organic Extraction and Sample Preparation, SW-846 Update 3, Dec.1996
EPA 3500C, Organic Extraction and Sample Preparation, SW-846 Update 4, Feb.2007
EPA 8330, Nitroaromatics and Nitramines by HPLC, SW-846 Update 3, Sep. 1994
EPA 8330A, Nitroaromatics & Nitroamines by HPLC, SW-846 Update 3, Jan. 1998
DoD Quality Systems Manual, Rev 4.1, April 2009

Related C&T SOP's:
QA 1.4, Balance Calibration Check & Maintenance
QA 1.5, Calibrating & Maintaining Temperature Controls
QA 1.6, Pipet Calibration Check Procedures
QA 4.1, Establishing Control Limits
QA 4.4, Determining Method Detection Limits (MDL)

SAMPLE PRESERVATION & HOLDING TIME:

Preservation:	Store at 4°C.
Holding Time:	14 days from sample collection until extraction. 40 days from extraction until analysis.

EQUIPMENT:
Mortor & pestle
Dessicator
Cooled sonic bath

SAFETY:
Standard precautionary measures used for handling other organic compounds should be sufficient for the safe handling of the analytes targeted by Method 8330. The only extra caution that should be taken is if handling the analytical standard neat material for the explosives themselves and in rare cases where soil or waste samples are highly contaminated with the explosives. If little site information is known, it is advisable to screen soil or waste samples using

Method 8515 to determine whether high concentrations of explosives are present. Soil samples containing as much as 2% of 2,4,6-TNT have been safely ground. Samples containing higher concentrations should not be ground in the mortar and pestle. Lumps of material that have a chemical appearance should be suspect and not ground. Explosives are generally a very finely ground grayish-white material. All of the target compounds are either used in the manufacture of explosives or are the degradation products of explosive compounds. When making stock solutions and handling samples, use caution; wear safety glasses, gloves, and a lab whenever handling samples, standards, or reagents.

INTERFERENCES

Any sticks, leaves, rocks, or other objects must be removed as they are not part of the extraction matrix and their presence will interfere with the sample being ground to pass through a 30-mesh sieve. Water is also a potential interference as its presence decreases the extraction solvent's ability to retain target analytes. Any water layer should be decanted from the sample and the sample must be dry so that is can be ground properly.

QC REQUIREMENTS:

A Method Blank (MB), Laboratory Control Sample (LCS), Matrix Spike (MS), and Matrix Spike Duplicate (MSD) must be prepared for each batch of 20 or fewer samples. If insufficient sample was submitted to extract an MS/MSD, a Blank Spike (BS) and Blank Spike Duplicate (BSD) may be substituted for the LCS/MS/MSD.

Surrogate compounds are added to each sample, method blank, and spike prior to extraction. If the surrogate recoveries for any sample fail recovery limits, that sample must be re-extracted. If the surrogate recoveries for the method blank, blank spike, blank spike duplicate, or laboratory control sample fail recovery limits, the entire batch must be re-extracted.

A method detection limit (MDL) study will be conducted annually, by extracting a minimum of seven aliquots of a low-level laboratory control sample. Control limits are updated semi-annually based on control charts.

QC DEFINITIONS:

A.) Method Blank (MB):

A method blank is extracted and analyzed with every batch, to demonstrate that the extraction and analysis procedures have not contributed to any detected sample results. If any target compounds are detected in the method blank, the entire batch must be re-extracted.

B.) Laboratory Control Sample (LCS), or Blank Spike (BS)/ Blank Spike Duplicate(BSD):

An LCS is extracted and analyzed with every batch, to demonstrate that the extraction and analysis procedures are effective in the absence of matrix interferences. If the recovery of any of the spike compounds is outside the acceptance limits, the entire batch must be re-extracted.

Note: If insufficient sample was submitted to extract an MS/MSD, extract a duplicate LCS, labeling the first “BS” and the duplicate “BSD”. This method of labeling is used by LIMS to determine if there is a duplicate or only one LCS.

C.) Matrix Spike/ Matrix Spike Duplicate: A matrix spike and matrix spike duplicate are extracted and analyzed with every batch, to demonstrate the effectiveness of the procedure in real-world samples which may include matrix interferences. If the recovery or RPD of any spike compound is outside acceptance limits, the batch may need to be re-extracted.

Note: The MS and MSD should be concentrated to the same final volume as the matrix spike sample (MSS).

D.) Surrogate:
A surrogate is a compound (or compounds) that is added to every sample prior to extraction in order to monitor the accuracy of the extraction and analysis. These are compounds that are not normally found in environmental samples but are chemically related to the compounds of interest, and so behave in a similar fashion. Surrogate recovery failure indicates a problem with the process; any sample that demonstrates recovery failure must be re-extracted.

SAMPLE PREPARATION:

1.) For the method blank and laboratory control sample (or BS/BSD), weigh out 5 $\pm$ 0.2g of kiln-fired Ottawa sand into a solvent-rinsed and labelled Petri dish. Place in the desiccator overnight.

2.) For the samples, decant and discard any water layer. Discard objects such as sticks, leaves and rocks. Then take the most visually representative aliquot from the sample possible; if the sample is visibly non-homogenous, record this observation in the benchbook.
Weigh out approximately 10g into a solvent-rinsed and labelled Petri dish. Place in the desiccator overnight.

Note: **DO NOT DRY SAMPLES AT ELEVATED TEMPERATURES!**

3.) If any sample appears to be wet after drying overnight in the desiccator, dry sample for another night.

4.) For the matrix spike and matrix spike duplicate, review the job sheets to determine if any of the clients requested an MS/MSD on their sample. If not, select a sample so that matrix QC is rotated throughout the laboratory's clients, so that no one client's samples predominate over a period of time.

a.) Weigh out just over 30g of sample into a pre-cleaned, solvent-rinsed 16 oz wide mouth glass jar. Place in the desiccator overnight.

b.) When dry, *thoroughly* and carefully homogenize the sample, then weigh out three 5g (± 0.2g) portions into separate Petri dishes labeled with the sample number and "MSS", "MS", and "MSD" respectively. Record the sample weights to 0.01g.

5.) Grind and homogenize each dried sample, including QC thoroughly in an acetonitrile-rinsed mortar to pass a 30-mesh sieve.

Note: Soil samples containing as much as 2% of 2,4,6-TNT have been safely ground. Samples containing higher concentrations should not be ground in the mortar and pestle. Lumps of material that have a chemical appearance should be suspect and not ground. Explosives are generally a very finely ground grayish-white material.

6.) To the LCS, MS, and MSD, add 20 µL of the 8330 Matrix Spiking Solution #1 (8330_CAL1) and then add 20 µL of the 8330 Matrix Spiking Solution #2 (8330_CAL2). The LCS, MS and MSD, are spiked directly from the Stock Standard Solution. See Appendix_2 for infomation on the Matrix Spiking Solutions. Document the LIMS WS# of each Spiking Solution and the volume used in the benchbook.

7.) To every sample, including each batch QC sample, add 400 µL of the 8330 Surrogate Solution (8330SURR). Document the LIMS ID of the Surrogate Solution and the volume used in the benchbook.

EXTRACTION PROCEDURE:

1.) Place a 5.0 ± 0.2g subsample of each soil sample in a 20-mL labelled glass scintilation vial.

2.) Add 10.0 mL of Acetonitrile, cap, and vortex swirl for one minute.

3.) Place the sample vials in a cooled ultrasonic bath(<20 ^{o}C) for 18 hours.

4.) After the 18 hour sonication, allow samples to settle for 30 minutes.

5.) Decant as much Acetonitrile as possible into a second glass scintilation vial labeled with the sample ID and batch number.

Note: Do not make the final dilution into 5% CaCl2. This is the analysts' responsibility and should be performed just prior to analysis, as one of the target compounds (Tetryl) degrades rapidly in the presence of water/MeOH.

6.) Store extracts at 4°C (± 2°C) in Delfield refrigerator # 9.

DOCUMENTATION:

A.) Benchbooks:
Every extraction must be completely documented in the appropriate benchbook. Any changes must be made with a single line through the incorrect entry and intialed and dated by the chemist making the change. The benchbook entries must include the following:

Sample number, accompanied by the unique container identifier (A-> Z)
Initial sample weight
Final sample volume
LIMS WS# and volume used for all surrogate and spike standards
Manufacturer and lot# for all solvents, reagents, and filters
Observations concerning unusual sample appearance, odor, behavior
Errors during extraction (spilled, possibly double spiked, etc.)

B.) LIMS:
All extraction weights, volumes, and WS# must be entered into the prep entry database. It is very important that the entries are accurate and complete, as LIMS uses these to calculate sample concentrations and spike results.

C.) Peer Review:
The benchbook entries and LIMS batch sheets must be reviewed by another extraction chemist, an analyst, or Group Leader. The benchbook and LIMS batch sheet must be signed by the extraction chemist and the peer-reviewer. The peer-reviewer should make a photocopy of the benchbook page, attach it to the LIMS batch sheet, and file it in the ‘Done’ box.

WASTE DISPOSAL:
After extraction, place the sample vials in the fume hood and allow to dry. The dried waste then goes into the soil waste drum for later disposal.

Excess extract volume should be stored in the Delfield refrigerator for a minimum of 40 days, then transferred to the flammable waste stream drum.

POLLUTION PREVENTION:
Prepare only as much spiking and surrogate standard as can be used within the shelf-life of the standard.

REVISION HISTORY
This is revision 0, revision 1 was changed as follows:
-Revision History section was added

-latest update citations are referenced
-matrix spike LIMs name revised

APPENDIX_1: **8330 SOIL EXTRACTION SUMMARY**

Sample Weight:	5g
Extraction Solvent:	Acetonitrile
Extraction Temp:	< 20 °C in sonicator bath
Extraction Time:	18 hours
Final Extraction Solvent:	Acetonitrile *
Final Volume:	10 mL

WARNING: ***Do NOT heat these samples or extracts!***

Surrogate:	*8330SURR* 1,2-Dinitrobenzene @ 50 µg/mL	Add:	400 µL
Spike:	*8300_CAL1* All targets @ 1000 µg/mL	Add:	20 µL
	8330_CAL2 All targets @ 1000 µg/mL	Add:	20 µL

* *Note:* Do not make the final dilution into 5% $CaCl_2$ as described in method 8330. This is the analysts' responsibility and should be performed just prior to analysis, as one of the target compounds (Tetryl) degrades rapidly in the presence of water/MeOH.

APPENDIX_2: STANDARDS & REAGENTS

Source Standards
Enter all source standards into LIMS immediately upon receipt, using the Standards Menu "Source Standard Maintenance". The LIMS SS-name is unique to the vendor that the source is obtained from; if a source standard is obtained from a different vendor, a new SS-name must be assigned and the information entered in the "Source Standard Entry" table before the standard can be assigned an SS#. The standards listed below were those in use at the time this document was written, however standards may be purchased from different vendors so long as they are traceable through LIMS and the Standards Prep Logs.

Certificates of Analysis should be obtained from the vendor of each source standard; the certificates should be labeled with the LIMS ID and the date received and filed in the 3-ring binder. Source standards usually have an expiration date set by the manufacturer. If no expiration date is listed, the expiration date is one year from date received.

Working Standards
Document the preparation of all working standards in the standards prep benchbook and in the LIMS through the "Working Standards Maintenance" menu; LIMS will then assign a working standard number (WS#). The LIMS WS-name is not neccesarily unique to the source standard vendor but *is* unique to the compound list and concentrations contained in the working standard; if the concentration or compounds in the working standard changes, a new WS-name, compound list and concentrations must be entered in the "Working Standard Entry" table before the standard can be logged in and assigned a WS#. It it *very important* to enter this information correctly, as LIMS uses this information to calculate spike and surrogate recoveries.

The benchbook entry should include the prep date, LIMS SS# and concentration, volume of SS used, solvent name, solvent volume, solvent lot#, final volume and concentration of WS, expiration date of WS, and prep chemist's initials.

Working standard solutions containing 2,4-DNT and 2,6-DNT expire 30 days after preparation from the source standards per (Method 8330 Sec. 5.4.2) unless any of the source standards expire before the 30 days. If any of the source standards expire before the 30 days, change the expiration date of the working standard to match the earliest expiration date of the stock standards. All other working standard solutions expire 90 days after preparation from the source standards unless any of the source standards expire before the 90 days. If any of the source standards expire before the 90 days, change the expiration date of the working standard to match the earliest expiration date of the stock standards. **The expiration date of the working standard *must not* exceed the expiration date of any of the source standards from which it was made**.

Reagents

For any reagents that are not used directly from the bottle but are prepared by an extraction lab chemist, the preparation of all reagents, including dilutions into Millipore DI water, must be documented in the reagent prep benchbook. Each reagent must be assigned a unique ID, based on the manufacturer and the date prepared. Whenever a new lot # of reagent is received, it must be screened before use to ensure that no contamination will interfere with the analysis. The reagent manufacturer and lot# must be documented in the extraction prep log for each batch to aid in trouble-shooting when problems occur.

SOURCE STANDARDS

Label each vial with the contents, LIMS SS#, and expiration date. Store the standards in refrigerator #5 at 4°C ± 2°C. *Do not* store standards in a refrigerator containing samples or extracts.

Surrogate Source Standard @ 1,000 µg/mL (ug/mL = mg/L):
- Restek Cat. No. 31453
  LIMS Name: *8330_SURR*

Matrix Spiking Solution @ 1,000 µg/mL:
- Restek Cat. No. 33905
  LIMS Name: CAL_SPIKE

WORKING STANDARD SOLUTIONS

Note: Store all standards in a refrigerator at 4°C ± 2°C.

Surrogate Solution: LIMS Name: *8330SUR*R
Dilute the 1,000 µg/mL stock solution 1:20.

1.) Add about 65 mL of Methanol to a 1000 mL Class-A volumetric flask.
2.) Add 5.0 mL of the 1,000 µg/mL surrogate solution.
3.) Add Methanol to volume and mix well by inverting and rotating the flask.
4.) Transfer to 40 mL amber VOA vials labeled with the LIMS WS# and expiration date.

Spike Solutions: Use Matrix Spiking Solutions #1 and #2 (8330_CAL1 and 8330_CAL2) to spike the Laboratory Control Sample (LCS), Matrix Spike (MS), and Matrix Spike Duplicate (MSD).

REAGENTS

Acetonitrile, EMD Omni-solv, VWR Catalog# EM-AX0142-1, Store at room temperature in a Flammables cabinet for up to 6 months.

Methanol (for making the surrogate working standard), EMD Omni-solv, VWR Catalog# EM-MX0488-1, Store at room temperature for up to 1 year.

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Mercury Analysis of Solid Samples
by Cold Vapor AA Method EPA 7471

SOP Table of Contents

Scope
Reference
Sample Preservation & Holding Time
Safety
Interferences
QC Requirements
Equipment
Calibration Standards Preparation
Sample & Batch QC Preparation
Analysis
Determining Sample Concentrations
Evaluating Batch QC Results
Reviewing and Reporting Results
Documentation
Pollution Prevention
Waste Disposal
Revision History

Appendix_1: Digestion Summary
Appendix_2: Reagents & Standards
Appendix_3: Sample Dilutions
Appendix_4: Calculations
Appendix_5: Instrument Conditions
Appendix_6: Instrument Maintenance
Appendix_7: Using the Leeman Software

Mercury Analysis of Solid Samples by Cold Vapor AA

A. SCOPE
This procedure describes the sample preparation and analysis for determining the concentration of mercury in soils, sediments, bottom deposits, and sludge-type materials. The reporting limit for this procedure, using a 0.5g sample, is 0.02 mg/Kg.

In this procedure, organometallic compounds are broken down and converted to mercuric ions by digesting the sample with permanganate and persulfate under heated conditions. The concentration of mercury in the resulting digestate is then determined by cold vapor atomic absorption (CVAA). This procedure is not applicable to Waters or Liquid Samples (see Metals SOP Section 5.1, Method 7470A).

B. REFERENCES
EPA 7471A, Mercury in Solid or Semisolid Waste *(Manual Cold-Vapor Technique)*, SW846 Update 1, Sept 1994
EPA 7471B, Mercury in Solid or Semisolid Waste *(Manual Cold-Vapor Technique)*, SW846 Update 2, Feb 2007

Additional SOP's and Guidance Documents:
EPA 7000A, *Atomic Absorption Methods*, SW-846 Update 3, Feb 2007
NELAC Chapter 5 Quality Systems, 6/5/2003, Sec 5.5.4-5.5.6
DoD Quality Systems Manual, Version 4.1, 4/22/09
DoE Quality Systems Manual, Version 2.2, October 2006
C&T SOP QA 1.4, *Balance Calibration Check & Maintenance*
C&T SOP QA 1.5, *Calibrating & Maintaining Temperature Controls*
C&T SOP QA 1.6, *Pipet Calibration Check Procedures*
C&T SOP QA 1.9, *Calibration of Volumetric Glassware*
C&T SOP QA 1.5, *Calibrating Thermometers and Maintaining Temperature Controls*
C&T SOP QA 4.1, *Establishing Control Limits*
C&T SOP QA 4.4, *Determining Method Detection Limits (MDL)*

C. SAMPLE PRESERVATION & HOLDING TIME
Preservative: No chemical preservation. Store at 4°C.
Holding time: 28 days

D. SAFETY
Mercury is a highly toxic element that is also somewhat volatile. The reagents used in this procedure are corrosive and can be harmful if inhaled. Always perform the digestions under a hood and take steps to avoid inhaling vapors generated in the process.

This procedure uses concentrated acids that will cause injury if allowed to contact skin or eyes.

Gloves and safety glasses and appropriate clothing should be worn at all times when handling samples, standards, or reagents. Aqua regia must be used in the fume hood due to toxic and corrosive fumes.

E. INTERFERENCES

Mercury is a relatively volatile element that may be vaporized if the digestion temperature is not closely monitored. Sulfide interferences are reduced through use of potassium permanganate in the digestion step. Samples with high organic content may reduce the potassium permanganate and require additional permanganate be added during digestion.

F. QC REQUIREMENTS

Initial Calibration curves must be composed of a minimum of a blank and five standards, which are digested in the same manner as the associated samples. Instrument should be calibrated before each analytical sequence. The correlation coefficient must be > 0.995.

Initial Calibration Verification (ICV) standards must be prepared from stock standards received from a source other than those used for the initial calibration curve. The ICV is analyzed prior to sample analysis with a recovery between 90-110%. (%D = +/- 10%)

Initial Calibration Blank (ICB) is a reagent blank that follows the ICV. Mercury must not be detected above one half (1/2 or 50%) of the Reporting Limit (RL).

Continuing Calibration Verification (CCV) standards must be analyzed after every 10 samples, including batch QC samples, and at the end of the analytical sequence. Since the instrument is calibrated every day, the concentration of the CCV standards is analyzed in the mid-range of the calibration curve. The recovery for the CCV must be within 80-120%. If a CCV fails to meet the recovery criteria, the analysis is terminated, the instrument re-calibrated, and all samples analyzed after the last passing CCV must be reanalyzed.

Calibration Blanks (CCB) are reagent blanks that follow every CCV. Mercury must not be detected above the MDL.

Batch QC: The following quality control (QC) samples must be prepared in the same manner as the analytical samples at a rate of once per twenty or less samples. C&T in-house limits are based on control charts and are updated semi-annually; see the associated SOP *Mercury QC Limits, Table-1* for the current limits.

Method Blank (MB): Digest and analyze a method (prep) blank with each batch of 20 samples or less to demonstrate that the glassware and reagents are free of contamination. Mercury must not be detected above one half (1/2 or 50%) of the Reporting Limit (RL)

Blank Spike / Blank Spike Duplicate (BS/BSD): Digest and analyze a blank spike and a blank spike duplicate for every batch of 20 samples or less to demonstrate that the procedure is accurate (measured by the *recovery*) and precise (measured by the *RPD*) in the *absence* of matrix interferences.

Matrix Spike (MS) / Matrix Spike Duplicate (MSD): Digest and analyze an MS/MSD with every batch of samples to demonstrate the accuracy and precision of the process on real-world samples.

Note: Client- or project-specific quality assurance project plans (QAPPs) may require an MS/MSD in place of the SDUP and SSPIKE. For batches containing samples from these projects, the QAPP requirement takes precedence over this SOP.

Sample Interference Verifications: The method recommends that whenever a new or unusual matrix is encountered, a series of tests be performed to ensure that neither positive nor negative interferences are distorting the accuracy of the reported values. These are optional steps that should be implemented for any batch containing “Level 3” or Level 4” samples, as nearly all Department of Defense project plans include this requirement. These should also be analyzed whenever the analyst suspects that sample viscosity, salt content, or other matrix interferences are likely.

Serial Dilutions: Analysis of a 5x dilution should agree within + 10% (90-110% recovery) of the original determination if the concentration of the element in diluted aliquot is greater than the reporting limit. If not a chemical or physical interference should be suspected.

Post Digest Spikes: An analyte spike added to a portion of a prepared sample digest, or its dilution, should be recovered to within 75-125% of the known value. The spike addition should produce a minimum level of 10 times and a maximum level of 100 times the instrumental detection limit. If the spike is not recovered within the specified limits a matrix effect should be suspected.

Method Detection Limit (MDL): MDL studies must be performed annually for each instrument and matrix, in order to demonstrate that the sample preparation and analysis procedures are adequate to meet required reporting limits. The MDL is determined by digesting and analyzing at least 7 replicates of a low-level blank spike, determining the standard deviation for each element, and applying a multiplier. See the QA SOP “Determining MDLs” for details.

Instrument Detection Limit (IDL): The IDL is determined by analyzing seven instrument blanks on three non-consecutive days. The standard deviation of the calculated concentrations is determined for each day; the IDL is the sum of the three standard deviations.

Glassware: Class-A digestion tubes should be purchased, or the calibration of the disposable digestion tubes must be verified, to within 3%, for each lot received. Per the SOP for Calibrating Volumetric Glassware.

G. EQUIPMENT (See Appendix_5 for instrument conditions)
Heating block capable of maintaining 90-95 °C for 30 minutes. Calibrated annually along with the thermometers for temperature control within +/- 2C by SOP for Temperature Controls
LEEMAN "Hydra AA" automated mercury analyzer
Disposable 70 mL digestion tubes, CPI Catalog # 4370-010010
0.22 µm Syringe Filters, Millipore Catalog # SLGV033NK

Note: If the digestion tubes are not certified by the manufacturer or vendor as Class-A, the accuracy of each lot must be verified prior to use according to SOP for Volumetric Labware. This is done by selecting 5 digestion tubes from the lot and filling them to 50mL with 20°C deionized water and weighing it on an analytical (4 decimal) balance; the weights must fall within 3% of the expected weights (48.5 – 51.5g) or the lot may not be used for direct measurement of sample or digestate volume.

H. PREPARE THE CALIBRATION STANDARDS
Initial calibration standards: Add the following volumes of a 0.100 µg/mL mercury working standard to a series of digestion tubes then follow the digestion procedure below, starting at Step-13 so the volume of the standards matches that of the samples. The LIMS ID of the 100 µg/mL working standard must be documented in the digestion log. These standards expire after 24 hours.

Cal Level	Final Concentration (ug/L)	Volume of 0.100µg/mL Working Std (mL)	Final Volume (mL)
Cal Zero	0.0	0.00	50
Std #1	0.2	0.10	50
Std #2	0.5	0.25	50
Std #3	2.0	1.00	50
Std #4	5.0	2.50	50
Std #5	10.	5.00	50

ICV and CCVs: The Initial Calibration Verification (ICV) standard must be made from intermediates obtained from a different manufacturer than those used to make the initial calibration curve and the Continuing Calibration Verification (CCV) standards may be prepared from either of the sources. *Note:* The US Army Corp of Engineers recommends that the CCV's be prepared from the same source standards as the ICAL curve. An acceptable ICV must be analyzed before any samples are loaded. If the ICV does not pass acceptance criteria and samples were analyzed immediately following it, the entire calibration must be reanalyzed, as there is no way of determining what affect the sample matrix would have on any subsequent ICV analysis.

An instrument blank should not precede each CCV – if it's necessary, the instrument rinse/bake times must be adjusted instead. Instrument Blanks may be analyzed after high concentration samples regardless of whether a sample or CCV follows (see analysis/sequence section)

The concentrations of the calibration verification standards should be varied over the course of the sequence (NELAC Ch.5.9.5.2.2.b requirement), but should not be analyzed at the extreme high or low points. Prepare the mid-range standards (levels # 2, # 3, # 4) listed above, using the appropriate 0.100 µg/mL working standard, adding the standard to an empty, labeled tube then following the digestion procedure beginning at Step-13. Document the LIMS ID of the 0.100 µg/mL working standard in the digestion benchbook. These standards expire after 24 hours.

Calibration Verification Acceptance Limits:

	Spike Level (ug/L)	Lower Limit (ug/L)	Upper Limit (ug/L)
ICV (+10%)	5.00	4.50	5.50
CCV1 (+20%)	2.50	2.00	3.00

I. PREPARE THE SAMPLES & BATCH QC

1) Turn on the digestion block and allow it to come to temperature (95°C).

2) Check samples out of the cold room and allow them to come to room temperature.

3) Calibrate the autopipette at each of the volumes needed to spike the batch QC samples and create the initial calibration standards. Document this calibration in the pipette benchbook.

4) Verify that the balance has been calibrated for the day; if it has not, calibrate it and document the calibration in the balance benchbook.

5) Select sufficient digestion tubes for all of the samples in the batch plus a method blank, blank spike, blank spike duplicate, and two matrix QC samples. Label each tube with a sample number or QC-type.

6) Homogenize a 5-10g subsample and weigh a representative 0.5g (+ 0.05g) portion of the homogenized subsample into the bottom of the tared digestion tube labeled with that sample number.

7) Record the sample number, container *letter*, and sample weight (to 0.01g), in the benchbook. Place the digestion tube in the rack.

8) For the method blank (MB), simply label an empty digestion tube.

9) Laboratory Control Samples (LCS = Blank Spike) should be spiked between the low and middle level of the calibration standards. Prepare the blank spike (BS) and blank spike duplicate (BSD) by adding 1.25 mL of the 0.100ug/L Hg working standard to each of two empty digestion tubes.

10) Review the job sheets to determine if any of the clients in the batch requested that matrix QC be done on their sample. If so, use that sample for the MS/ MSD, otherwise choose a sample for batch QC so that matrix QC is rotated throughout the laboratory's clients and so that no one client's samples predominate over a period of time.

11) In the absence of alternative specifications, choose samples for matrix spiking such that QC is rotated through clients and projects so that no one client's samples predominate over a period of time. Job/Project instructions are higher priority; if project specific QC specifies selection of specific client samples for MS/MSD, follow this guidance.

12) Prepare the matrix spike (MS) by adding 1.25 mL of the 0.100 ug/mL Hg working standard to a second 0.5g aliquot of the sample being used for QC.

13) Prepare the matrix spike duplicate (MSD) by adding 1.25 mL of the 0.100 ug/mL Hg working standard to a third 0.5g aliquot of the sample being used for QC.

14) To each sample and batch QC sample, add 5 mL DI water and swirl to mix.

15) To each sample and batch QC sample, add 5 mL of concentrated aqua regia and swirl to mix. Document the C&T ID of the aqua regia in the digestion benchbook.

16) Place the rack containing the samples, batch QC, and calibration standards in the 95°C digestion block for 2 minutes then remove from the block and cool to about room temperature.

17) Add 25 mL deionized water to each tube. Swirl to mix.

18) Add 7.5 mL of 5% $KMnO_4$ solution to each tube. Mix thoroughly.

19) Put the tubes in the digestion block. Set the block to maintain a temperature of 90-95°C for 30 minutes. In the digestion log, record the time and temperature when the samples are placed into the digestion block and then both again when they are removed from the block.

Note: The temperature readout of the digestion block will typically be higher than the actual temperature of the digestion tubes, so the actual digestion temperature should be monitored using a thermometer in a reagent blank. The temperature should be within + 2°C of the expected temperature. Adjust as necessary until this requirement is met.

20) After about 5 minutes, verify that the digests are still purple in color. If they are not, slowly add just enough granular $KMnO_4$ to make the color persist. Use the same $KMnO_4$ as used to make the liquid solution.

Note: C&T uses granular $KMnO_4$ because samples high in organics often require too much additional permanganate to make addition of the liquid solution feasible.

21) Cool to about room temperature then add 3 mL of sodium chloride-hydroxylamine-HCL to reduce the excess permanganate.

22) Add 20 mL deionized water, cap and invert to mix.

23) Filter each sample, including batch QC samples, through a clean 0.45µm syringe filter and place the filtrate into a labeled autosampler tube.

24) Document the LIMS standard number of the spikes and all C&T reagent ID's of the reagent in the digestion benchbook.

Enter the prep data into LIMS and have the entry peer-reviewed before beginning sample analysis so that LIMS can apply the correct prep dilution factor. If any corrections are made to the prep entry after samples are analyzed, that sample data must be reprocessed through LIMS. The digestion benchbook entries should include:

C&T sample ID's and unique container identifier, date of sample digestion, initial volume or weight of sample, and final digestate volume, identity of QC samples (spikes, duplicates & LCS), amount of spikes added and LIMS identification numbers of all spiking solutions,
a list of all reagents used (C&T ID or manufacturer and lot number),
indication of whether or not the digests were filtered after digestion,
any unusual occurrences observed during the digestion procedure

25) Use the scanner to scan in the prep information from the digest log and save it under the batch number.

J. ANALYSIS

26) While the samples are digesting, refill the stannous chloride reservoir and make sure the inlet tube is submerged in the reagent; document the reagent ID in the digestion log. Turn on the lamp and allow the instrument to equilibrate for about an hour.

27) Place the filtered samples in an autosampler rack beginning with the initial calibration standards. The initial calibration standards should be analyzed in order of increasing concentration, with the lowest standard at or below the reporting limit and the highest standard defining the upper end of the quantitation range. The correlation coefficient must be > 0.995 before the analysis can proceed.

28) CCV standards must be run after every ten samples, or more frequently if desired, and at the end of the sequence; alternate the CCV concentration across the calibration range over the course of the sequence, excluding the high and low ICAL points. A typical sequence is outlined below:

Initial Calibration Standards (run lowest to highest)
Initial Calibration Verification (ICV, second source) standard
Initial Calibration Blank (ICB)
Prep Blank
Blank Spike
Blank Spike Duplicate
Sample
Sample Duplicate
Sample Spike
4 more samples
Continuing Calibration Verification (CCV) standard
Continuing Calibration Blank (CCB)
10 samples
CCV
CCB
etc……

29) Use the data acquisition software to control the autosampler. The instrument will automatically add the 10% stannous chloride reagent and analyze the samples.

More detailed information regarding this procedure may be obtained by consulting the operations manual for the instrument.

30) If a **Serial Dilution (SER)** is needed, measure 2.0 mL of the MSS (unspiked aliquot of the "matrix spike sample") into a digestion tube. Add 8.0mL of the 5% blank (to match the reagent concentrations) and swirl to mix. Decant into an autosampler tube and add to the sequence.

31) If a **Post-Digestion Spike (PDS)** is needed, pipette 10.0 mL of the MSS into a digestion tube. Add 0.5 mL of a 0.1 mg/L standard. Cap and swirl to mix. Decant into an autosampler tube and add to the sequence.

K. Determining Sample Concentrations
Quantitation is based on comparison of the measured absorbance for the sample against the initial calibration curve, with adjustments for the sample preparation concentration factor and instrument dilution factor. See Appendix_4 for example calculations. Concentrations are expressed as micrograms per liter (µg/L) or milligrams per kilogram (mg/kg).

All results are reported on a wet-weight ("as received") basis unless otherwise requested by the client. If the client requests 'dry-weight' corrections, the 'wet-weight' results in the results database are corrected for moisture by LIMS when producing the final report forms.

1.) **Evaluate the CCV's & CCB's**
Target elements must not be detected in the calibration blanks at any level greater than the method detection limit (DoD QSM specifications allow a wider CCB limit: no analytes present at 2x the MDL). The concentration of the CCV must be varied within the calibration range, over the course of the sequence. If the %D for any element is outside this acceptance window, LIMS will use the following to determine if the associated results are reportable:

If the CCV fails the %D criterion due to a high response but mercury was not detected above the reporting limit in the associated samples, the sample results may be reported without reanalysis, as the high bias does not affect the sample results.

If the CCV fails the %D criterion due to a high response and mercury *was* detected above the reporting limit in any of the associated samples, the samples must be reanalyzed.

If the CCV fails the %D criterion due to a low response, all of the associated samples must be reanalyzed as the low bias may result in false negatives or misquantitation.

2.) **Evaluate the Batch QC Results**
Method Blank: The results for the method (preparation) blank should be < 1/2 RL. If reanalysis confirms the contamination, use the following steps to determine if the sample results may be reported:

a. If the concentration in the blank is below the reporting limit but above 1/2 of the reporting limit, document the contamination on the batch sequence summary and the data review checklist and report the data without reanalysis.

b. If mercury was found in the blank but was not detected in the associated samples, the data may be reported and the problem narrated.

c. If mercury was found the method blank and was also detected in the associated samples, but the level in the samples is greater than 10x the level in the blank, document the contamination on the batch sequence summary and the data review checklist and report the data without reanalysis.

d. If mercury was detected in the blank were also detected in the associated samples, but at levels less than 10x the level in the blank, and reanalysis confirms the problem, the samples containing the contaminant must be redigested and reanalyzed. Initiate a Corrective Action Report (CAR) and redigest and reanalyze all of the affected samples.

Blank Spike (BS) and Blank Spike Duplicate (BSD): The recoveries and RPD should fall within C&T in-house limits, or the samples associated with it may need to be redigested and reanalyzed. Use the following steps to determine if the sample results may be reported:

a. If a high recovery is observed but mercury was not detected in the associated samples, note the failure on the Data Review Checklist and report the data without re-digestion, as the potential high bias does not affect the sample results.

b. If a high recovery is observed and the samples contain mercury at levels above the reporting limit, those samples must be re-digested.

c. If a high RPD is observed but the recoveries are within acceptance limits and the samples do not contain mercury, note the failure on the Data Review Checklist and report the data without re-digestion, as the lack of good precision data does not affect ND samples.

d. If a high RPD is observed and the samples contain mercury at levels above the reporting limits, those samples must be re-extracted.

Note: Project-specific limits may be different than C&T acceptance limits. For samples submitted for that project or client, the project-specific limits supersede C&T limits.

Matrix QC (SSPIKE/SDUP or MS/MSD): The recoveries and RPD should fall within C&T in-house limits, or the samples associated with it may need to be redigested and reanalyzed. Use the following steps to determine any necessary corrective action:

a. If the concentration in the sample is greater than the linear range and the sample needs to be rerun for quantitation, report the MS/MSD with a LIMS-flag of “>LR” on those recoveries, without reanalysis.

b. If the concentration in the sample is within linear range but the concentration in the matrix spikes is greater than the linear range, LIMS will apply a “>LR” flag to those recoveries. Report the data without reanalysis.

c. If the concentration is greater than 4x the spiking level, LIMS will apply a “NM” (for “Not Meaningful”) flag to those recoveries. Report the data without reanalysis.
Note: If the concentration is greater than the spiking level, LIMS will flag and footnote that concentration for the client’s attention.

d. If recoveries fail but the RPD is within acceptance limits, matrix interference is usually suspected. Narrate the failure and report the data without reanalysis (except for USACE, or other Level 3 or Level 4 projects that always require reanalysis).

e. If the recoveries are within limits but the RPD fails, and an isolated problem cannot be identified and documented, reanalyze the sample and matrix spikes.

3.) **Evaluate the Sample Results**

Review any batch QC sample data first to verify that samples from that batch can be reported, then review the sample results to identify any samples that need to be rerun and/ or diluted.

Examine the sample results to verify that all results are within the linear range. If the concentration is greater than the highest calibration standard for that element, use volumetric pipettes to prepare a dilution of the digestate so that the concentration falls in the fall in the middle of the ICAL curve to reduce likelihood of bias found at either end of curve. See appendix 3 below for procedures used to prepare sample dilutions.

If a sample is analyzed at multiple dilutions, compare the sample results across the various dilutions to verify that the dilutions were prepared correctly. Do the results make sense or is there a discrepancy between the runs? If there seems to be a discrepancy, reanalyze the sample to confirm the results.

4.) **Reviewing & Reporting Results**

1.) Open a web browser and go to the main METALS page.
2.) Under Recent Sequences, choose the instrument and then choose the sequence you want to review.
3.) Check the sequence for any errors. LIMS takes the run information directly from what is typed in the sequence. Typing errors can affect how the data is processed by LIMS.
If you need to make any changes to the sequence, click FIX. Make any needed changes and click UPDATE.
4.) Once everything is correctly processed in the sequence, review the sequence to see that all samples, STDs, and QC meet acceptance criteria. Samples and QC should have an “OK” flag in the QC column of the sequence, otherwise reanalysis may be required. Once the sequence has been reviewed, it must be signed in the REVIEW APP.
5.) Open REVIEW APP for the sequence by choosing the sequence (e.g. MET14 / 05/08/07) under the Review pull down list on the top right corner of the sequence page.
6.) Two windows should open. One window shows the main Review App page. One window shows the documents (e.g. reports, scanned documents, Form 1s, etc).
IMPORTANT! Make sure you are logged in with your own user initials. The current user's initials are displayed on the bottom left corner of the review app window. To logout, click the user initials and Review App will ask you to login.
7.) The sequence is listed on the left frame of the Review App page. Clicking on an item on that list will display the LIMS report and any associated documents.
8.) The analyst adds a comment that the sequence has been verified/reviewed for either all files in the sequence or those files the analyst has reviewed if the sequence is still running.
9.) From another open web browser go back to the main METALS page and click on run chooser.

10.) Enter the login number, analysis or rgroup (metals), and matrix for the job to be reported. Choose the result(s) to be reported for each sample and QC for the job.
11.) Select reports from the top left side of the screen. From the views section in the upper right select possible. This will list the possible reports that can be printed. Select the reports to be printed and print to nowhere. This will select and lock the final results in the LIMS database.
12.) From the REVIEW APP page you left open previously, enter the batch number in the box in front of the search button and click the button.
13.) Review the results and sign the main page of the batch.
14.) From a different open web browser, go back to the main METALS page and enter the job number you wish to report in the search box and select search. Open REVIEW APP for the job by choosing the job (e.g. 214373 METALS Filtrate) under the Review pull down list on the top right corner of the page.
15.) Review the results and sign the main page for the job.
16.) Inform the group leader that the job is ready for review.
17.) When the reviewer or group leader does the final review of the job, the level III or IV packages are generated at that time.

L. POLLUTION PREVENTION

Vent the mercury analyzers into the fume hood. Purchase only sufficient standard and reagent volume to use within the expiration date, to reduce the volume of laboratory waste.

M. WASTE DISPOSAL

Soil samples must be returned to the coldroom for later inclusion in the lab's soil waste stream. Excess digest volume should be discarded in the "Corrosives" waste stream. Excess standard volume should be included in the "Mercury" waste stream.

N. REVISION HISTORY

This is revision 13, Revision 12 was changed in the following manner:

• Corrections in grammar and syntax were made to make the procedure clearer.
• References were changed to reflect revised standards and update the method from the A to the B revision of EPA 7471
• Language was added to clarify procedural compliance to NELAP and DoD QSM and ISO 17025 standards.
• This Revision History section was added to comply with standard C&T SOP format
• Guidance relating to dilution of samples was changed to dilute samples to mid range of the ICAL curve rather than the upper range.
• Reviewing and Reporting procedures were changed to reflect the change to paperless processes.

APPENDIX_1: MERCURY SOIL DIGESTION SUMMARY

Sample Weight: 0.5 g (+ 0.05 g)

Spike: 2.5 mL of HG 0.1 STD

1st Digestion: + 5 mL DI water
+ 5 mL aqua regia
95 °C
2 minutes

2nd Digestion: + 25 mL DI water
7.5 mL of 5% $KMnO_4$ solution
90 - 95 °C
30 minutes (add $KMnO_4$ crystals if color fades)

Final: + 3.0 mL NaCl-Hydroxylamine HCl
repeat until appearance is stable & colorless
+20 mL DI water

Filtration: 0.45 µm Syringe Filter, including all batch QC

APPENDIX _ 2: REAGENTS & STANDARDS

The standards and reagents listed below are those in use at the time this procedure was written. Alternative Reagents and Supplies may be substituted provided the substitution is equivalent and meets all calibration, quality control, and traceability requirements.

REAGENTS

Document the preparation of all reagents, including dilutions into DI water, in the reagent prep benchbook; include the date and analyst initials, the name of the reagent, and the manufacturer and lot# in the benchbook entry. Assign a unique ID, based on the type of reagent and the date prepared; record this ID in the digestion benchbook each time the reagent is used. Label each reagent bottle with the date received, date opened, and the expiration date.

Deionized Water, ASTM Type II (ASTM D1193)

Hydroxylamine Hydrochloride ($H_2NOH.HCl$), reagent grade
Fisher Scientific catalog # H330-500
Store in a tightly sealed plastic bottle at room temperature for up to 5 years

Nitric Acid (HNO_3), concentrated, InstraAnalyzed grade
JT Baker catalog # 7697-37-2
Store in a Corrosives cabinet for up to 2 years

Hydrochloric Acid (HCl), concentrated, InstraAnalyzed grade
JT Baker catalog # 7647-01-0
Store unopened bottles in the corrosives cabinet.
Store open bottles under the fume hood for up to five years.

Potassium permanganate ($KMnO_4$), reagent grade, mercury free
Fisher Scientific catalog # P279-212
Store in an amber glass bottle at room temperature for up to 5 years

Potassium persulfate ($K_2S_2O_8$), reagent grade
Fisher Scientific catalog # P281-500
Store at room temperature for up to 5 years

Sodium Chloride (NaCl), reagent grade
Fisher Scientific catalog # S671-500
Store in a tightly sealed plastic bottle at room temperature for up to 5 years

Sulfuric Acid Concentrated (H_2SO_4), concentrated, InstraAnalyzed grade
JT Baker, VWR catalog # JT9691-3
Store in a Corrosives cabinet for up to 2 years

Aqua Regia: *prepare daily*
Prepare immediately before use in a glass bottle
1.) Measure 96 mL concentrated nitric acid (HNO_3) into a glass bottle
2.) Add 32 mL concentrated hydrochloric acid (HCl).
3.) Swirl to mix.

5% Nitric Acid (HNO_3)
1.) Add 50mL concentrated HNO_3 to 950mL deionized water.
2.) Swirl to mix.
3.) Store at room temperature for up to 1 year

5% Potassium permanganate ($KMnO_4$, saturated) by weight: *prepare monthly*
1.) Dissolve 50 g of potassium permanganate in about 400mL DI water in a 1L volumetric flask.
2.) Agitate to dissolve the solids.
3.) Bring to 1,000 mL with DI water.
4.) Cap and invert at least 3 times to homogenize.
5.) Store in an amber glass bottle at room temperature, under a fume hood, for up to one month.

5% Potassium persulfate ($K_2S_2O_8$), by weight: *prepare monthly*
1.) Dissolve 50 g of potassium persulfate in 1000 mL DI water.
2.) Store in an amber glass bottle at room temperature in the hood for up to one month.

Sodium chloride-hydoxylamine hydrochloride solution: *prepare monthly*
1.) Add 120g of sodium chloride to about 200mL of DI water in a 1L volumetric flask.
2.) Add 120g of hydroxylamine hydrochloride.
3.) Agitate to dissolve the solids.
4.) Dilute to 1,000 mL with DI water.
5.) Cap & invert at least 3 times to homogenize.
6.) Store in a glass bottle at room temperature, under a fume hood, for up to one month.

10% Stannous Chloride ($SnCl_2$) “flow reagent” solution: *expires after 5 days*
1.) Add 40g stannous chloride to 200 mL of DI water.
2.) Add 30 mL HCl and swirl to mix.
3.) Add 170 mL of DI water to bring the total volume to 400 mL.
4.) Agitate the mixture to dissolve any residual tin chloride crystals.
5.) Store under a hood, in an amber glass bottle at room temperature for up to 5 days; prepare fresh solution more frequently if it turns slightly yellowish.

SOURCE STANDARDS
Source standards are those purchased from a chemical manufacturer or vendor and they should be traceable to NIST. For source standards, the LIMS S-name is unique to both the composition (compound list) of the standard *and* to the vendor of that standard. A new S-name must be assigned whenever the composition is changed or when the standard is obtained from a different vendor; the information must then be entered in the “Standard Definitions” table before the new standard is assigned an S#.

Certificates of Analysis should be obtained from the vendor of each source standard; each standard should be traceable to NIST. If the supplier did not provide a certificate, call and request that a copy be faxed. Source standards usually have an expiration date set by the manufacturer. If no expiration date is listed, the expiration date is one year from date received.

Enter the lot#, date received, and expiration date of each source standard into LIMS immediately upon receipt, using the Standards Menu “Standard Inventory”.

Label the Certificate of Analysis with the LIMS S#, date received and expiration date (if not already listed on vial) then file the certificates the 3-ring binder. Label each vial with the contents, LIMS S#, and expiration date. Store source standards in the vendor’s bottle at room temperature, until the expiration date.

Analytes Concentration Supplier & Catalog# LIMS S- Name

Mercury, primary source std.
Plasma-Pure Part # 603-8062 1,000 ug/mL Leeman # 7439-97-6 HG LEEMAN

Mercury, second source std. 1,000 ug/mL CPI # S4400-1000331 HG SS

WORKING STANDARDS
Working standards are those prepared at C&T. For working standards, the LIMS S-name is not unique to the source standard vendor but *is* unique to the compound list and concentrations contained in the working standard; if the concentration or compounds in the working standard changes, a new S-name, compound list and concentrations must be entered in the “Standard Definitions” table before the standard is logged in and assigned an S#. It is very important to enter this information correctly, as LIMS uses this information to calculate spike and surrogate recoveries.

Verify that the LIMS expiration date does not exceed the Source Standard expiration date. If it does, change the working standard expiration date to that of the source standard. **The expiration date of the working standard *must not* exceed the expiration date of any of the source standards from which it was made**.

In the Standards Benchbook, enter the prep date, LIMS S#, concentration, and volume of each source standard used, the LIMS S-name, final volume and concentration of the working standard, expiration date, and prep chemist's initials.

In LIMS, enter the prep chemist's initials, prep date, and S# of all source standards used to make the working standard; LIMS will then assign a working standard number (S#).

Prepare working standards by diluting source standards to volume in a Class-A volumetric flask. Label the standard vial with the contents, the LIMS WS#, the expiration date of the standard, and the prep chemist's initials.

Procedure:
1.) Prepare all working standards in a **200 mL Class-A volumetric flask**, initially adding about 200mL DI water.
2.) Add 10mL concentrated nitric acid to about 100mL DI water (so the final acid concentration in 200mL final volume will be 5%). Swirl to mix.
3.) Add the volumes and standards listed below to make each standard.
4.) Bring to volume with DI water.
5.) Cap and invert three times to mix. Allow sufficient time, during each inversion, to mix thoroughly.

All volumes given below may be adjusted proportionally to yield more or less of the solution required. All spiking standards should be analyzed to verify their concentration **PRIOR TO USE**. The data from these screens should be stored in the appropriate binder.

MERCURY STANDARDS PREP

Working Standard &
Conc. WS Conc.
(ug/mL) Using
“Source” Std Add Vol (mL)
Source Std LIMS
S-Name Shelf
Life
Primary Source
Intermediate 10.0 HG LEEMAN 2.0 HG 10 STD 3 mo
Primary Source
Working Std 0.100 HG 10 STD 2.0 HG 0.1 STD 48 hr

2nd Source
Intermediate 10.0 HG SS 2.0 HG 10 REF 3 mo
2nd Source
Working Std. 0.100 HG 10 REF 2.0 HG 0.1 REF 48 hr

DAILY CALIBRATION STANDARDS

CAL Standard &
Conc. (µg/mL) Final Volume
(mL) Using
Source Std Add Vol (mL)
Source Std LIMS
S-Name
CAL-Zero 0.0 ug/L 50 DI water 0.00
CAL-1 0.2 ug/L 50 HG 0.1 STD 0.10
CAL-2 0.5 ug/L 50 HG 0.1 STD 0.25
CAL-3 2.0 ug/L 50 HG 0.1 STD 1.00
CAL-4 5.0 ug/L 50 HG 0.1 STD 2.50
CAL-5 10.0 ug/L 50 HG 0.1 STD 5.00

ICV 5.0 ug/L 50 HG 0.1 REF 2.50 HG ICV

CCV-1 0.5 ug/L 50 HG 0.1 STD or REF 0.25 CCV1 HG
CCV-1 2.0 ug/L 50 HG 0.1 STD or REF 1.00 CCV2 HG
CCV-1 5.0 ug/L 50 HG 0.1 STD of REF 2.50 CCV3 HG

APPENDIX _ 3: SAMPLE DILUTIONS

If the sample concentration is greater than the highest point in the calibration curve, prepare a dilution at a level that will bring the absorbance into the middle of the calibration range. This dilution must be injected onto the instrument within 24 hours of completion of the digestion; if the digestion was completed more than 24 hours previously, redigest the sample in a new batch and dilute the digestate prior to analysis.

Examine the original sample data to determine what dilution factor will be required to bring the absorbance down to the middle of the calibration range.

Using calibrated auto-pipettes, add the following volumes sample followed by HNO_3 acidified (5% vol:vol) deionized water to a 15mL disposable centrifuge tube. Cap and invert three times to mix, allowing sufficient time for complete mixing with each inversion.

DILUTIONS
Instrument
Dilution Factor (IDF) Digestate Volume Add Volume (mL)
Acidified DI Water Final Volume (mL)

2 5.0 mL 5.0 10
5 2.0 mL 8.0 10
10 1.0 mL 9.0 10
20 0.50 mL 9.5 10
50 0.20 mL 9.8 10
100 0.10 mL 9.9 10

If a sample should need a dilution of more than 100x, prepare a 100x dilution first, then use that to make subsequent dilutions.

SERIAL DILUTIONS
Instrument
Dilution Factor Using Primary
Dilution Volume of Primary
(100x) Dilution Add Volume (mL)
Acidified DI Water Final Volume
(mL)

500 100x 2.0 mL 8.0 10
1,000 100x 1.0 mL 9.0 10
2,000 100x 0.5 mL 9.5 10
5,000 100x 0.2 mL 9.8 10
10,000 100x 0.1 mL 9.9 10

APPENDIX _4: CALCULATIONS

SAMPLE CONCENTRATION

Raw Amt (ug/L) = (m * intensity) + b

Where: m = first-order coefficient (slope) from initial calibration (LIMS a1)
b = intercept (LIMS a0)

LIMS then applies the sample prep information to calculate the mercury concentration in the sample by dividing the total ug by the prep dilution factor.

Conc (ug/L or mg/Kg) = Raw Amt * Vf / Si * IDF

Where: Vf = Final Digestate Volume (mL)
Si = Sample Initial Volume (mL) or Weight (g)
IDF = Instrument Dilution Factor

Moisture Corrected Results:
Dry Weight Concentration (mg/Kg) = "As Received" Conc. / ((100 - %moisture)/100)

BATCH QC CALCULATIONS

Percent Recovery (%R):
The recovery is the measured concentration divided by the true concentration of the spike.

%Recovery = (Cf – Cs) / (Cws * Vws/ S) *100

Where: Cf = final measured concentration in the spiked sample
Cs = measured concentration in the un-spiked aliquot of sample
Cws = concentration of the spiking standard
Vws = volume used, of the spiking standard
S = Sample weight or volume

Relative Percent Difference (RPD):
The RPD is the absolute value of the difference in concentrations divided by the average of the concentrations.

%RPD = |(Cs - Cdup)| / ((Cs + Cdup)/2) * 100

Where: Cs = measured sample concentration
Cdup = measured concentration in the duplicate

For soil MS/MSD's where the sample weights are not weight-targetted, the expected concentations will vary with sample weight (because the same volume of spike standard is being added to different weights of sample) and must be accounted for when calculating RPD:

%RPD = |((Wms/Wmsd)*Cms - Cmsd)| / (((Wms/Wmsd) * Cms + Cmsd)/2) * 100

CALIBRATION EQUATIONS

%Drift used calibration verification
Used for calibration verification standards, to determine if the instrument is still in control:

% Difference (% Drift) = %D = ((C1 - C2) / C1) * 100

Where: C1 = Concentration of the Calibration Verification Standard
C2 = Measured concentration

Linear Regression Equations

Y = mx + b

Where: y = response (Ax for external standard, or Ax/Ais for internal standard)
Where Ax = Area of compound
Ax / Ais = Area of compound divided by area of internal std
x = concentration (Cx for external standard, or Cx/Cis for internal standard)
m = slope
b = intercept

Slope (m) = $[(\sum wx_iy_i * \sum w) – (\sum wx_i * \sum wy_i)] / [(\sum w * \sum wx_{i2}) – (\sum wx_i * \sum wx_i)]$

Intercept (b) = $y_{avg} – (m * x_{avg})$

Correlation Coefficient (r)

$$r = \frac{[(\sum w * \sum wx_iy_i) – (\sum wx_i * \sum wy_i)]}{\sqrt{[(\sum w * \sum wx_{i2}) – (\sum wx * \sum wx_i)] * [(\sum w * \sum wy_{i2}) – (\sum wy_i * \sum wy_i)]}}$$

Coefficient of Determination (r_2) = r * r

Where: x_i = individual values for the independent variable (concentration)
y_i = individual values for the dependent variable (response, area)
w = weighting factor (for no weighting w = 1)
x_{avg} = average of the x-values
y_{avg} = average of the x-values

STANDARDS PREP & OTHER QC

Spiking Batch QC for Waters

Calculate the volume of working standard to add to make the LCS/ MS/ MSD using the following:

Vws (mL) = Cf / (Cws * pdf * 1000)

Where: Vws = Volume (mL) of Working Standard to use for spike
Cf = Final Concentration in sample (ug/L)
Cws = Concentration (ug/mL) of the Working Standard
Pdf = Final Volume of Extract (mL) / Initial Volume of Sample (mL)

Spiking Batch QC for Soil

Calculate the volume of working standard to add to make the LCS/ MS/ MSD using the following:

Vws (mL) = Cf / (Cws * pdf * 1000)

Where: Vws = Volume (mL) of Working Standard to use for spike
Cf = Final Concentration in sample (ug/Kg)
Cws = Concentration (ug/mL) of the Working Standard
Pdf = Final Volume of Extract (mL) / Initial Mass of Sample (g)

Make a Working Standard from a Source (Stock) Standard:

Determine the volume of source standard needed to make a given volume of working standard:

Vss (mL) = Vws * Cws / Css

Where: Vss = Volume of Source Standard (mL) needed to make new standard
Vws = Final Volume (mL) of Working Standard
Cws = Final Concentration (ug/mL) of the Working Standard
Css = Concentration (ug/mL) of the Source Standard

APPENDIX_5: INSTRUMENT CONDITIONS

Instrument: MET-04, Leeman Hydra AA
MET-14, Leeman Hydra AA

Argon Purity 99.99%
Max Pressure 75 psi
Flow Rate 0.6 L/min

Oven Radiator Temperature: 125 °C (to maintain 50°C gas temperature)

Lamp Current 6 – 10 mAmps

Auto Sampler 30s sip duration
75s rinse time

Peristaltic Pump Rate 6.0 mL/min Sample
0.8 mL/min Reagent (Stannous Chloride)

Auto-Integration 4 replicates

Baseline Correction 1 point

Note: The conditions listed above were those in use at the time this document was written and may be modified at the analyst's discretion, so long as those changes are documented in the instrument maintenance log.

APPENDIX_6: INSTRUMENT MAINTENANCE

All parts & supplies can be ordered from LEEMAN; see instrument manual for part numbers. Alternate suppliers and part numbers may be used at the analyst's discretion.

Document all maintenance events must be documented in the instrument maintenance benchbook. Include each of the following in the benchbook:

reason for the maintenance,
the initials of the person performing the maintenance and the date performed,
description of maintenance performed,
resolution (If the maintenance was due to poor instrument performance, did the maintenance solve the problem?)

Pump windings must be replaced whenever cracked or leaking.

The **drying tube** (gas-liquid separator) should be cleaned by sonicating in 1:1 nitric acid/ DI water for 30 minutes whenever the glass begins to turn yellow from tin chloride precipitation.

The **gas-liquid separator** should be cleaned with spectrophotometric grade isopropyl alcohol if the cell appears smudged or dirty.

The **lamp** should be ordered when the voltage is at 10mV and replaced when the voltage reaches 15mV.

DIGESTION BLOCK INSTRUCTIONS

1) Turn on the block.
2) On the keypad, press ENTER/ START.
3) Select AUTO.
4) Set the temperature to 95°C.
5) Allow block to warm up for 20 - 30 minutes.
6) Use a thermometer, in a water-filled digestion tube, to verify that the temperature is 95°C.
7) Adjust the temperature setting as needed so that the digestate temperature will be maintained at 95°C.
8) Place the digestion tubes in the bath.
9) Set the timer for 30 minutes for soil samples (2 hours for water).
10) Document the time and temperature in the digestion log.

APPENDIX_7: USING THE LEEMAN SOFTWARE
Install # 62541
800-533-6267 David Sherwin, Field Service Engineer

The Hg analyzer provides a windows interface that interacts with LIMS once a batch has been entered, prepped and assigned a batch number. Before using the windows interface you must have a LIMS batch number and LIMS prep information.

1. Open the WinHg Runner Program.

1.1. Click on the icon in the quick launch bar
1.2. Open the program from Start->Programs->WinHg->WinHg
1.3. Execute the program file located at C:\Hg\WinHg.exe
1.4. If all else fails, you can click Start->Run and on command line type "C:\Hg\WinHg.exe"

2. Use the functions under the **Control** tab to control the parts of the instruments such as the pump, gas and lamp. When starting up, go to this tab first. Here you will:

2.1. Turn on the lamp
2.2. Turn on the pump (5mL/min)
2.3. Turn on the gas (0.6 L/min)

Note: Should you ever get very negative calibrations (~ -2000 or more), use the lamp adjust feature on this tab.

3. Create a new dataset (sequence) by selecting "New Dataset" from File menu.

3.1. A window will pop up asking for new dataset name.
3.2. Enter the date in MMDDYY format, e.g. 041305.
Note: For the second batch to be run on any given day, you will need to append a letter to the name, for example, 041305a, 041305b and so on.
3.3. Another window will pop-up asking for batch number.
3.4. Enter your current batch number here.

4. Use the **Standards** Tab to set up the calibration once your standards are made and in the autosampler tray.

4.1. On left hand side, depress the first six buttons (S1-S6), corresponding to your standards (0.0, 0.2, 0.5, 2.0, 5.0, 10.0),
4.2. Depress the "Rep 1" button, and click "Stnd Auto".
4.3. This will begin to establish your calibration curve.
4.4. Click on the Database (DB) button on the top tool bar.
4.5. Select the "Cal Curve" Tab to view your calibration curve in progress.

4.6. If your calibration curve has a Rho factor (correlation coefficient) of >0.995, click on the "Accept" button on the "Cal Curve" tab of the DB application.
4.7. Print the calibration curve by either:
a. clicking the print button from the top toolbar of DB application, or
b. selecting Print from the File menu
4.8. Delete any calibration points not included in the ACCEPTED curve, by selecting the line and clicking on the delete button of the Report tab.
Note: You can also uncheck the box to the left of the sample ID; however, this change is temporary, as the box will automatically be re-checked as additional samples are run and the list is "refreshed"

5. Use the **Rack Editor** interface to enter information about the samples in the autosampler rack.

6. Use the **Reports** to review the sequence and select the records to submit to LIMS.

6.1. Carefully review the samples in the sequence (or "Record List" as it is referred to on the Report tab of the DB application). Be sure that only the calibration points used in the accepted curve are included in this list. These will be the six StdXRepY that precede the ICV. *Note:* Whenever you reset calibration data (from the standards tab of the Runner application), the curve is reset, but the readings still exist.
6.2. Uncheck any samples you wish to omit.
6.3. Generate the reports by clcking on the "Generate Report" button of the Report Tab.
6.4. Format= Report, Destination = Printer.
6.5. Review this printed report carefully before submitting the data to LIMS. The data that appears on the printout also appears on the **Viewer** Tab of the DB application.
6.6. Format = PRN, Destination= Disk File
Note: The path should be G:\limsinp\met04\batchnumber.PRN.
To set the destination, you must navigate to the .../met04 directory by
1.5.1 Clicking on the button to the right of the output file path.
1.5.2 A dialog box will pop-up; in that folder, save the file as its batch number.
1.5.3 Click Save, or press <Enter>, then Click on "Generate Report".
6.7. After this step is complete, the data is dealt with entirely through the LIMS system.

Note: The default display path is "C:\Hg". This is the local hard-drive directory where the startup.ini, report specifications, protocol parameters and other instrument/system files are housed. Be sure that the "Report Specs" pull down menu displays "DLNEW". This is the format file that enables your insturment to talk to the Laboratory Information Management System (LIMS).

TROUBLE-SHOOTING LEEMAN HYDRA DATA

From the LEEMAN HYDRA AA User's Manual
The WinHG main program has seven tabs that outline its basic functions: main, control, standard, sample, output, report and utility. You will use all of these tabs on a daily basis, except for main and utility.

The typical operation of the HYDRA AA follows a sequence as below:
• Load or create a protocol which defines the operating parameters of the system
• Load or create a dataset where the data will be stored.
• Turn on Gas, Pump, and Hg lamp
• Sample rack editing (Add sample names, Dilution factors, Weight factors, etc.)
• Standard concentration and unit entry.
• Check standard concentration and limits entry.
• Run standards for calibration of HYDRA AA
• Accept calibration curve
• Run samples using calibration stored in protocol.
• Post run reporting of data.

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EPA 7470A QC Limits

C&T In-House Limits for
Sep 18, 2009 - Mar 17, 2010

Matrix	Analyte	LCS/LCSD Recovery	LCS/LCSD RPD	MS/MSD Recovery	MS/MSD RPD
Soil	Mercury	80 - 120	20	70 - 133	27

C&T internal list numbers: 71202

Curtis & Tompkins Laboratories
MDL Summary for EPA 7470A Soil
As of 10/22/09

Analyte	Units	MET04	MET14	Highest
Mercury	mg/Kg	0.0022	0.0063	0.0063

Curtis & Tompkins, Ltd.

MULTI-INCREMENTAL SUB-SAMPLING

Approved:

QA Director / Date	Client Services Manager / Date

Re-Approved:

Signature / Date	Signature / Date

**MULTI-INCREMENTAL
SUB-SAMPLING**

Read & Understood:

Signature / Date	Signature / Date
Signature / Date	Signature / Date
Signature / Date	Signature / Date
Signature / Date	Signature / Date
Signature / Date	Signature / Date
Signature / Date	Signature / Date
Signature / Date	Signature / Date
Signature / Date	Signature / Date
Signature / Date	Signature / Date

Curtis & Tompkins, Ltd.

MULTI-INCREMENTAL SUB-SAMPLING

SCOPE: The purpose of this procedure is to provide a more representative subsample for analysis than through traditional lab sampling techniques. The entire submitted sample is dried, reduced in particle size where possible, and sampled incrementally.

REFERENCES:

Guidance for Obtaining Representative Laboratory Analytical Subsamples from Particulate Laboratory Samples, EPA/600/R-03/027, November 2003

Improving Laboratory Performance Through Scientific Subsampling Techniques, C. Ramsey and J. Suggs, Environmental Testing & Analysis, March/April 2001

SAFETY:
Assume all samples received contain hazardous chemicals. Wear gloves, lab coats and safety glasses at all times when handling samples.

PROCEDURE:

1.) Empty entire field sample from its container into a clean, stainless steel pan. Spread the sample evenly across the pan to a depth of ¼ to ½ inch. Label the pan with the C&T sample number.

2.) If the sample is to be dried, place the pan in a rack. Let dry at room temperature until sample is visibly dry and free-flowing. This should take from overnight to as much as a week for wet or clay materials.

3.) Remove any extraneous materials such as twigs, large stones, etc. Sieve the remaining sample through a 2mm (#10) sieve (unless another procedure is specifically requested). Put the sieve into another clean stainless steel pan and pour some of the sample into the sieve. Shake vigorously back and forth to allow the smaller material to pass through the sieve. Any aggregates (clumps of dirt, etc.) are considered part of the sample and need to be broken up to pass through the sieve; this can be done with a clean wooden tongue depressor for smaller chunks, larger chunks may require use of a mortar and pestle.

4.) Save the material retained by the sieve in a separate clean glass jar labeled with the C&T sample number.

5.) Thoroughly mix the material that passed through the sieve.

6.) Verify that the balance has been calibrated earlier in the day. If it has not, calibrate it before proceeding.

7.) Label a pre-cleaned jar of the appropriate size for the analysis being done with the C&T sample number.

8.) Place the container on the scale and tare the scale.

9.) In the appropriate analysis or Soil Aliquot benchbook, write the C&T sample number and analysis.

10.) If necessary, redistribute the sample across the pan to a depth of ¼ to ½ inc. Incrementally sample the spread-out soil using a random grid pattern by collecting 30 increments of ~1g each for a 30g subsample (extractable organics) and ~0.33g for a 10g subsample (metals). For example, take five aliquots evenly spaced from each of six evenly-spaced rows. Use a small spatula or scoop with a flat bottom and rectangular shape to insure a representative distribution of particle sizes.

11.) Record the final weight and proceed to the applicable extraction or digestion procedure.

12.) Return the remaining sample to the original sample container.

Attachment D
Reporting Requirements

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GC/MS Level "D" Deliverables

Item #	Deliverable
1	Chain of Custody
2	Sample results with analysis and extraction/preparation dates
3	Summary of MS/MSD/Duplicate recoveries and control limits (listing or link with associated samples)
4	Summary of LCS/LCSD recoveries and control limits (listing or link with associated samples)
5	Method blanks (listing or link with associated samples)
6	Summary of instrument blanks - metals only (listing or link with associated samples)
7	Summary of surrogate recoveries
8	Summary of initial calibration data (RRF and %RSD, or r if applicable)
9	Summary of continuing calibration (%D and RRF)
10	Summary of internal standards (area response and retention time)
11	Summary of instrument tuning (listing or link with associated samples, must show 12 hour clock)
12	Injection logs
13	Extraction/preparation logs
14	Case narrative to discuss anomalies
15	Raw data associated with the summary forms listed above
16	Raw data for item #2, which includes chromatograms, log books, quantitation reports, and spectra.

Note: The data deliverable package must have a table of contents and be paginated.

GC Level "D" Deliverables

Item #	Deliverable
1	Chain of Custody
2	Sample results with analysis and extraction/preparation dates
3	Summary of MS/MSD/Duplicate recoveries and control limits (listing or link with associated samples)
4	Summary of LCS/LCSD recoveries and control limits (listing or link with associated samples)
5	Method blanks (listing or link with associated samples)
6	Summary of surrogate recoveries
7	Summary of initial calibration data (RF and %RSD, r if applicable) Note: OC Pesticides analysis also requires summary results for DDT/Endrin breakdown, GPC, and Florisil (if performed)
8	Summary of continuing calibration (%D)
9	Injection logs
10	Extraction/preparation logs
11	Case narrative to discuss anomalies
12	Raw data associated with the summary forms listed above
13	Raw data for item #2, which includes chromatograms, log books, quantitation reports, and spectra.

Note: The data deliverable package must have a table of contents and be paginated.

QC LEVEL C DELIVERABLES DO NOT CONTAIN THE RAW DATA.

General Chemistry Level "D" Deliverables

Item #	Deliverable
1	Chain of Custody
2	Sample results with analysis and extraction/preparation dates
3	Summary of MS/MSD/Duplicate recoveries and control limits (listing or link with associated samples)
4	Summary of LCS/LCSD recoveries and control limits (listing or link with associated samples)
5	Method blanks (listing or link with associated samples)
6	Summary of initial calibration data (correlation coefficient, r)
7	Summary of continuing calibration (%D or % recovery), if applicable
8	Injection logs
9	Extraction/preparation logs, if applicable
10	Case narrative to discuss anomalies
11	Raw data associated with the summary forms listed above
12	Raw data for item #2, which includes log books, quantitation reports, and spectra.

Note: The data deliverable package must have a table of contents and be paginated.

Trace Metals Level "D" Deliverables

Item #	Deliverable
1	Chain of Custody
2	Sample results with analysis and extraction/preparation dates
3	Summary of MS/MSD/Duplicate recoveries and control limits (listing or link with associated samples)
4	Summary of LCS/LCSD recoveries and control limits (listing or link with associated samples)
5	Method blanks (listing or link with associated samples)
6	Summary of instrument blanks (listing or link with associated samples)
7	Summary of initial calibration data (% recovery - ICP) or (correlation coefficient, r - GFAA)
8	Summary of continuing calibration (%D or % recovery)
9	Injection logs
10	Extraction/preparation logs
11	Summary of ICP interference check (listing or link with associated samples)
12	Summary of graphite furnace AA, ICP post digestion spike, and serial dilution results
13	Summary of graphite furnace AA standard addition results (as required)
14	Case narrative to discuss anomalies
15	Raw data associated with the summary forms listed above
16	Raw data for item #2, which includes log books, quantitation reports, and spectra.

Note: The data deliverable package must have a table of contents and be paginated.

QC LEVEL C DELIVERABLES DO NOT CONTAIN THE RAW DATA.

HPLC Level "D" Deliverables

Item #	Deliverable
1	Chain of custody
2	Sample results with analysis and extraction/preparation dates
3	Summary of MS/MSD/Duplicate recoveries and control limits (listing or link with associated samples)
4	Summary of LCS/LCSD recoveries and control limits (listing or link with associated samples)
5	Method blanks (listing or link with associated samples)
6	Summary of instrument blanks - metals only (listing or link with associated samples)
7	Summary of surrogate recoveries
8	Summary of continuing calibration (%D and RRF)
9	Summary of internal standards (area response and retention time)
10	Summary of instrument tuning (listing or link with associated samples, must show 12-hour clock)
11	Injection logs
12	Extraction/preparation logs
13	Case narrative to discuss anomalies
14	Raw data associated with the summary forms listed above
15	Raw data for item #2, which includes chromatograms, log books, quantitation reports, and spectra.

Note: The data deliverable package must contain a table of contents and numbered pages.

QC LEVEL C DELIVERABLES DO NOT CONTAIN THE RAW DATA

ADaPT ELECTRONIC DATA DELIVERABLE FILE SPECIFICATIONS

The EDD consists of three separate, comma-delimited ASCII text files or Excel CSV files (two, if instrument calibration information is not required by the project). Each file corresponds to a database table. The tables are identified as the Analytical Results Table (Table A1), Laboratory Instrument Table (Table A2), and Sample Analysis Table (Table A3). Each file follows the naming convention of using the Laboratory Reporting Batch ID (SDG) followed by the table identifier (A1, A2, or A3), and then a ".txt" or ".csv" extension. For example, the EDD file names for a laboratory reporting batch identified as SDG001 that includes instrument calibration data would be as follows.

- SDG001A1.txt or SDG001A1.csv
- SDG001A2.txt or SDG001A2.csv (A2 file is optional)
- SDG001A3.txt or SDG001A3.csv

ANALYTICAL RESULTS TABLE (A1 FILE)

The Analytical Results table contains results and related information on an analyte level for field samples and associated quality control samples (excluding calibrations and tunes). A result record must exist for each analyte reported in a method (specified in the project library) for every field sample and laboratory method blank analyzed by that method. Laboratory control samples and matrix spikes must have a result record for every spiked analyte and surrogate (if applicable) specified in the project library. Table A1 lists the field names and descriptions for the Analytical Results Table (A1). The project library is a reference table that both the EDD error checker and validation applications use when processing the EDD. The project library is populated with information from the project QAPP.

LABORATORY INSTRUMENT TABLE (A2 FILE)

The Laboratory Instrument table contains results and related information on an analyte level for instrument initial calibration standards, initial calibration verification standards, continuing calibration standards, and GC/MS tunes. A record must exist for each target analyte reported in a method (specified in the project library), for every calibration type (QCType) associated to samples reported in the EDD. Initial calibrations, initial calibration verifications, and associated samples are linked to each other using a unique Run Batch ID for every distinct initial calibration. Continuing calibrations and associated samples are linked to each other using a unique Analysis Batch ID for every distinct continuing calibration. GC/MS tunes are linked to initial and continuing calibrations (and hence samples) using the Run Batch and Analysis Batch IDs respectively. Depending on the level of validation required by the data user, the Laboratory Instrument table may not be requested in the deliverable. Table A2 lists field names and descriptions for the Laboratory Instrument Table (A2).

SAMPLE ANALYSIS TABLE (A3 FILE)

The Sample Analysis table contains information related to sample and QC analyses (excluding calibrations and tunes), analytical methods, batch IDs, and sample preparation on a sample basis. A record exists for each sample/method/matrix/analysis type combination. Table A3 lists field names and descriptions for the Sample Analysis Table (A3).

EDD FIELD ELEMENTS

The EDD Field Elements listed in Table A1, A2, and A3 specify the type of electronic information from the analytical laboratories for populating the fields each file. These include the field name and sequence, field name description, and field type and length for each table. Field elements in the EDD are sequenced according to the order they appear in Tables A1, A2, and A3. For example, in the Analytical Result table (the A1 file), the field "ClientSampleID" will always be the first piece of information to start a new line of data (or database record), followed by the fields "LabAnalysisRefMethodID", "AnalysisType", and so on.

The name, description, data type, character length, and standard value requirements for each field are listed in Tables A1, A2, and A3. Field standard values are listed in Table B. Table C lists standard values for methods and analytes. Certain fields in each file require information for a given combination of sample, matrix, method, analyte type, and calibration or QC type records. These are required fields. Tables D1, D2, and D3 indicates the required fields for each table according to the instrument category (method), matrix, analyte type, sample, and QC or calibration type record.

When creating an EDD as a text file, use the ASCII character set in a file of lines terminated by a carriage return and line feed. No characters are allowed after the carriage return and line feed. Enclose each data field in double quotes (") and separate each field by commas (comma delimited). Data fields with no information (null) may be represented by two consecutive commas. For example, in the Sample Analysis table, since the "Collected", "ShippingBatchID", and "Temperature" fields do not apply to laboratory generated QA/QC samples, the record for a Laboratory Control Sample by Method 8270C would be entered as follows. Note that the first two fields ("ProjectNumber" and "ProjectName") are omitted in this example.

"LCSW100598",,"AQ","LCSW100598","LCS",,"8270C",…

Do not pad fields with leading or trailing spaces if a field is populated with less than the maximum allowed number of characters. In the above example, although the "MatrixID" field can accommodate up to 10 characters, only 2 characters were entered in this field.

Table A1: Field Descriptions for the Analytical Results Table (A1)

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
ClientSampleID	Client's identifier for a sample If a sample is analyzed as a duplicate, matrix spike, or matrix spike duplicate, append suffixes DUP, MS and MSD respectively to the Client Sample ID (i.e., MW01DUP, MW01MS, and MW01MSD). For the Method Blanks, LCS, and LCSD enter the unique Laboratory_Sample_ID. Do not append suffixes for dilutions, reanalyses, or reextacts. For example, MW01DL and MW01RE are not allowed.	Text	25	
LabAnalysisRefMethodID	Laboratory reference method (i.e., 8260B, 8270C, 6010B, etc). The Lab Analysis Ref Method ID is specified in the project library or QAPP.	Text	25	
AnalysisType	Defines the analysis type (i.e., Dilution, Reanalysis, etc.). This field is critical for distinguishing results from the same compound when multiple analyses are submitted for the same sample and method (i.e. dilutions, reextracts, etc).	Text	10	See Table B

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
LabSampleID	Laboratory tracking number for field samples and lab generated QC samples such as method blank, LCS, and LCSD Append suffixes DUP, MS and MSD, without an intervening hyphen or space, for the sample duplicate, matrix spike, and matrix spike dup respectively (i.e., 9810001DUP, 9810001MS, and 9810001MSD). Suffixes may be applied to the Lab_Sample_ID to designate dilutions, reanalyses, etc. The Lab_Sample_ID must be unique for each Method Blank, LCS, and LCSD. Each Method Batch must contain records for a matrix spike for inorganic methods and a matrix spike and matrix spike duplicate for organic methods. Parent sample records must exist for each MS and MS/MSD. If an MS or MS/MSD is shared between two EDDs, records for the MS or MS/MSD and its parent sample must exist in the Analytical Results table for both EDDs.	Text	25	
LabID	Identification of the laboratory performing the analyses	Text	7	See Table B
ClientAnalyteID	CAS # or unique identification If a CAS # is not available, use a unique identifier provided by the Contractor. For TICs from GC/MS analyses, enter retention time in decimal minutes as the Client Analyte ID. The Client Analyte ID for a particular target analyte is specified in the project library or QAPP. Each sample analysis (i.e. dilutions and reanalyses) must report the full target analyte list including surrogates if applicable. For the LCS, LCSD, MS, and MSD, only report the spike compounds for all methods, and surrogates for organic methods. For organics, surrogates must be reported for each analysis submitted (i.e. reanalyses and dilutions).	Text	12	
AnalyteName	Chemical name for the analyte (i.e., Benzene, Lead) The Analyte Name is specified in the project library or QAPP.	Text	60	
Result	Result value for the analyte Entries must be numeric even though this is a text field. For nondetects of target analytes and spikes, do not enter “ND” or leave this field blank. If an analyte or spike was not detected, enter the reporting limit value corrected for dilution and percent moisture as applicable.	Text	10	
Lab_Qualifiers	A string of single letter result qualifiers assigned by the lab based on client-defined rules and values The “U” Lab Qualifier must be entered for all non detects. Other pertinent lab qualifiers may be entered with the “U” qualifier. Order is insignificant.	Text	7	See Table B
Detection_Limit	The detection limit value for the analyte being measured	Text	10	
Detection_Limit_Type	Specifies the type of detection limit (i.e., MDL, IDL, etc.)	Text	10	See Table B
Retention_Time	The time expressed in decimal minutes between injection and detection for GC/MS TICs only.	Text	5	
Analyte_Type	Defines the type of result such as surrogate, spike, internal standard, and target compound.	Text	30	See Table B
Percent_Recovery	The percent recovery value of a spike or surrogate compound Enter the recovery value as a numeric character. If the spike or surrogate was not recovered because of dilution, enter “DIL”. If a spike or surrogate was not recovered because of matrix interference, enter “INT”. If a spike or surrogate was not recovered because it was not added to the sample, enter “NS”.	Text	5	See Table B

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
Relative_Percent_Difference	The relative percent difference (RPD) of two QC results such as MS/MSD, LCS/LCSD, and sample duplicates. Report RPD in the Sample Duplicate, LCSD, and MSD records only.	Number	Single	
Reporting_Limit	Reporting limit value for the measured analyte Factor in the dilution factor and percent moisture correction, if applicable. The Reporting Limit for each analyte and matrix in a given method is specified in the project library or QAPP.	Text	10	
Reporting_Limit_Type	Specifies the type of reporting limit (i.e., CRQL, PQL, SQL, RDL, etc). The Reporting Limit Type for each method and matrix is specified in the project library or QAPP.	Text	10	
Reportable_Result	This field indicates whether or not the laboratory chooses an individual analyte result as reportable. Enter “YES” if the result is reportable. Enter “NO” if the result is not reportable. This field applies to target analytes only. If only one analysis is submitted for a particular sample and method, enter “YES” for all target compounds (Analyte Type = TRG) and all TICs (Analyte Type = TIC, for GC/MS only). If two or more analyses are submitted for a particular sample and method (i.e. initial analysis, reanalysis and/or dilutions), enter “YES” from only one of the analyses for each target compound. For example: a sample was run a second time at dilution because benzene exceeded the calibration range in the initial, undiluted analysis. All target analytes are reported in each analysis. For the initial analysis, (Analysis Type = RES), enter “NO” for benzene and enter “YES” for all other compounds. For the diluted analysis (Analysis Type = DL), enter “YES” for benzene and enter “NO” for all other compounds. For TICs (Analyte Type = TIC), if more than one analysis is submitted for a particular sample and method, choose only one of the analyses where Reportable Result = YES for all TICs. For example, a sample was run a second time because one or more target compounds exceeded the calibration range in the undiluted analysis. Choose a particular analysis and enter “YES” for all TICS. In the other analysis enter “NO” for all TICs.	Text	3	See Table B

Note: Contains laboratory test results and related information for field and QC samples (excluding calibrations) on an analyte level.

Table A2: Field Descriptions for the Laboratory Instrument Table (A2)

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
Instrument_ID	Laboratory instrument identification	Text	15	
QC_Type	Type of instrument QC (i.e., Instrument_Performance_Check or type of calibration standard)	Text	10	See Table B
Analyzed	Analysis date/time for BFB, DFTPP, initial calibration verification standards, calibration verification standards, and continuing calibration standards. For the <u>initial calibration</u>, enter date and time of the <u>last</u> standard analyzed. Also, see comments about initial calibrations in the Alternate_Lab_Analysis_ID field name description.	Date/ Time	*	

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
Alternate_Lab_Analysis_ID	Common laboratory identification used for standards (i.e., VOA STD50, CCAL100, BFB50, etc). For initial calibration, enter ICAL. Information from the initial calibration is entered as one record for each analyte that summarizes the results of the initial calibration (i.e. %RSD, correlation coefficient, and avg RF). Records are not entered for each individual standard within the initial calibration.	Text	12	
Lab_Analysis_ID	Unique identification of the raw data electronic file associated with the calibration standard or tune (i.e., 9812101MS.DV). Leave this field blank for the initial calibration. See comments about initial calibrations in the Alternate_Lab_Analysis_ID field description. This field is only applicable where an electronic instrument file is created as part of the analysis.	Text	15	
Lab_Analysis_Ref_Method_ ID	Laboratory reference method (i.e., 8260B, 8270C, 6010B, etc.). The Lab Analysis Ref Method ID is specified in the project library or QAPP.	Text	25	
Client_Analyte_ID	CAS # or unique. If CAS # is not available, use a unique identifier provided by the Contractor. Records for each calibration must report the full target analyte list including surrogates as applicable. The target analyte list is specified for each method in the project library or QAPP.	Text	12	
Analyte_Name	Chemical name for the analyte (i.e., Benzene, Lead). The Analyte Name for each method is specified in the project library or QAPP	Text	60	
Run_Batch	Unique identifier for a batch of analyses performed on one instrument under the control of one initial calibration and initial calibration verification. The Run Batch ID links both the initial calibration and initial calibration verification to subsequently analyzed and associated continuing calibrations, field samples, and QC analyses. For GC/MS methods, the Run_Batch ID also links a BFB or DFTPP tune and the initial calibration and initial calibration verification standards to associated samples and method QC analyses. Even though methods 6010B and 6020 are treated as individual metals methods, all the metals reported under one initial calibration can use the same Run Batch ID. A new and unique Run Batch ID must used with every new initial calibration.	Text	12	
Analysis_Batch	Unique laboratory identifier for a batch of analyses performed on one instrument and under the control of a continuing calibration or continuing calibration verification. The Analysis Batch ID links the continuing calibration or calibration verification to subsequently analyzed and associated field sample and QC analyses. For GC/MS methods, the Analysis Batch ID also links the BFB or DFTPP tune and the continuing calibrations to associated samples and method QC analyses. Even though methods 6010B and 6020 are treated as individual metals methods, all the metals reported under one continuing calibration can use the same Analysis Batch ID. A new and unique Analysis Batch ID must be used with every new continuing calibration or continuing calibration verification. For GC methods, only report opening standards, do not include closing standards (unless the closing standard functions as the opening standard for a subsequent set of analyses, in which case a new and unique Analysis Batch ID is assigned). When dual or confirmation columns/detectors are used, enter results from the primary column/detector only (this is similar to CLP Pesticide reporting).	Text	12	

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
Lab_Reporting_Batch	Unique laboratory identifier for a batch of samples including associated calibrations and method QC, reported as a group by the lab (i.e. lab work order #, log-in #, or SDG). Links all instrument calibrations, samples, and method QC reported as a group or SDG.	Text	12	
Percent_Relative_Standard _ Deviation	The standard deviation as a percentage of the mean used to evaluate initial calibration linearity. Organic methods may use either %RSD or Correlation Coefficient. If applicable, enter the %RSD. Do not enter if the Correlation Coefficient is used.	Number	Single	
Correlation_Coefficient	The correlation coefficient resulting from linear regression of the initial calibration. For metals by ICAP, enter '1.0' if a two-point initial calibration was analyzed. Organic methods may use either %RSD or Correlation Coefficient. If applicable, enter the Correlation Coefficient. Do not enter if the %RSD is used	Number	Single	
Relative_Response_Factor	This field applies to GC/MS only. Enter the relative response factor for continuing calibration analyte records. Enter the average relative response factor for initial calibration analyte records. Refer to comments about initial calibration records in the field description for Alternate_Lab_Analysis_ID.	Number	Single	
Percent_Difference (or Percent Recovery)	For organic methods, this field is the difference between 2 measured values expressed as a percentage. If %RSD is reported, enter the % difference between the average response factor of the initial calibration (IC) and the response factor of the initial calibration verification (ICV) or continuing calibration (CCV). If correlation coefficient is used, enter the % difference between the true value and the measured value. The Percent_Difference is expressed as a negative or positive value. Do not express Percent_Difference as an absolute value. Use a negative value if the CCV or ICV response factor is less than the IC average response factor or, in the case of correlation coefficient, the CCV or ICV measured value is less than the true value. Use a positive value if the CCV or ICV response factor is greater than the IC average response factor, or in the case of correlation coefficient, the CCV or ICV measured value is greater than the true value. For inorganic methods, this field is the recovery of an analyte expressed as a percentage of the true amount (i.e., %R for a metal in the continuing calibration or initial calibration verification by Method 6010B).	Number	Single	
Peak_ID_01	Identifies individual ions for GC/MS tuning compounds (i.e., BFB, DFTPP). For BFB, m/z = 50; For DFTPP, m/z = 51	Number	Integer	
Percent_Ratio_01	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_01	Number	Single	
Peak_ID_02	Identifies individual ions for GC/MS tuning compounds (i.e., BFB, DFTPP). For BFB, m/z = 75; For DFTPP, m/z = 68	Number	Integer	
Percent_Ratio_02	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_02.	Number	Single	
Peak_ID_03	Identifies individual ions for GC/MS tuning compounds (i.e., BFB, DFTPP). For BFB, m/z = 95; For DFTPP, m/z = 69	Number	Integer	
Percent_Ratio_03	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_03.	Number	Single	

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
Peak_ID_04	Identifies individual ions for GC/MS tuning compounds (i.e., BFB, DFTPP). For BFB, m/z = 96 For DFTPP, m/z = 70	Number	Integer	
Percent_Ratio_04	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_04.	Number	Single	
Peak_ID_05	Identifies individual ions for GC/MS tuning compounds (I.e., BFB, DFTPP). For BFB, m/z = 173; For DFTPP, m/z = 127	Number	Integer	
Percent_Ratio_05	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_05	Number	Single	
Peak_ID_06	Identifies individual ions for GC/MS tuning compounds (i.e., BFB, DFTPP). For BFB, m/z = 174; For DFTPP, m/z = 197	Number	Integer	
Percent_Ratio_06	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_06	Number	Single	
Peak_ID_07	Identifies individual ions for GC/MS tuning compounds (i.e., BFB, DFTPP). For BFB, m/z = 175; For DFTPP, m/z = 198	Number	Integer	
Percent_Ratio_07	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_07.	Number	Single	
Peak_ID_08	Identifies individual ions for GC/MS tuning compounds (i.e., BFB, DFTPP). For BFB, m/z = 176; For DFTPP, m/z = 199	Number	Integer	
Percent_Ratio_08	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_08.	Number	Single	
Peak_ID_09	Identifies individual ions for GC/MS tuning compounds (i.e., BFB, DFTPP). For BFB, m/z = 177; For DFTPP, m/z = 275	Number	Integer	
Percent_Ratio_09	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_09.	Number	Single	
Peak_ID_10	Identifies individual ions for GC/MS tuning compounds (i.e., DFTPP). For DFTPP, m/z = 365	Number	Integer	
Percent_Ratio_10	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_10.	Number	Single	
Peak_ID_11	Identifies individual ions for GC/MS tuning compounds (i.e., DFTPP). For DFTPP, m/z = 441	Number	Integer	
Percent_Ratio_11	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_11.	Number	Single	
Peak_ID_12	Identifies individual ions for GC/MS tuning compounds (i.e., DFTPP). For DFTPP, m/z = 442	Number	Integer	
Percent_Ratio_12	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_12.	Number	Single	
Peak_ID_13	Identifies individual ions for GC/MS tuning compounds (i.e., DFTPP). For DFTPP, m/z = 443	Number	Integer	
Percent_Ratio_13	Ion abundance ratios of the GC/MS tuning compounds reported as a percentage. Linked to an individual Peak_ID_13.	Number	Single	

Note: Contains information related to tuning and calibration of laboratory instruments on an analyte basis.

* Date/time format is: MM/DD/YYYY hh:mm where MM = month, DD = day, YYYY = four digits of the year, hh = hour in 24 hour format, and mm = minutes.

Table A3: Field Description for the Sample Analysis (A3)

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
Project_Number	Project number assigned by the client	Text	30	
Project_Name	Project name assigned by the client	Text	90	
Client_Sample_ID	Client's identifier for a sample If a sample is analyzed as a duplicate, matrix spike, or matrix spike duplicate, append suffixes DUP, MS and MSD respectively to the Client Sample ID (i.e., MW01DUP, MW01MS, and MW01MSD). For the Method Blanks, LCS, and LCSD enter the unique Laboratory_Sample_ID. Do not append suffixes for dilutions, reanalyses, or reextracts. For example, MW01DL and MW01RE are not allowed.	Text	25	
Collected	Date/Time the sample of sample collection Leave this field blank for Method Blank, LCS, and LCSD. For Trip Blanks, enter the collection date of associated samples.	Date/ Time	*	
Matrix_ID	Sample matrix (i.e., AQ, SO, etc.)	Text	10	See Table B
Lab_Sample_ID	Laboratory tracking number for field samples and lab generated QC samples such as method blank, LCS, and LCSD Append suffixes DUP, MS and MSD, without an intervening hyphen or space, for the sample duplicate, matrix spike, and matrix spike dup respectively (i.e., 9810001DUP, 9810001MS, and 9810001MSD). Suffixes may be applied to the Lab_Sample_ID to designate dilutions, reanalyses, etc. The Lab_Sample_ID must be unique for each Method Blank, LCS, and LCSD. Each Method Batch must contain records for a matrix spike for inorganic methods and a matrix spike and matrix spike duplicate for organic methods. Parent sample records must exist for each MS and MS/MSD. If an MS or MS/MSD is shared between two EDDs, records for the MS or MS/MSD and its parent sample must exist in the Sample Analysis table for both EDDs.	Text	25	
QC_Type	This record identifies the type of quality control sample QC (i.e., Duplicate, LCS, Method Blank, MS, or MSD) For regular samples, leave this field blank.	Text	10	See Table B
Shipping_Batch_ID	Unique identifier assigned to a cooler or shipping container used to transport client or field samples. Links all samples to a cooler or shipping container. No entry for method blanks, LCS, and LCSD.	Text	25	
Temperature	Temperature (in centigrade degrees) of the sample as received.	Number	Single	
Lab_Analysis_Ref_Method_ID	Laboratory reference method (i.e., 8260B, 8270C, 6010B, etc.). The Lab Analysis Ref Method ID is specified in the project library or QAPP.	Text	25	
Preparation_Type	Preparation Method Number (i.e, 3010A, 3510C, 3550C, 5030B, etc.) For methods that do not have a specific preparation method number, use “Gen Prep”.	Text	25	See Table B
Analysis_Type	Defines the analysis type (i.e., Dilution, Reanalysis, etc.). This field is critical for distinguishing samples when multiple analyses are submitted for the same sample and method (i.e. dilutions, reextracts, etc). Enter “RES” for initial sample records.	Text	10	See Table B
Prepared	Preparation date/time	Date/ Time	*	
Analyzed	Date and time of analysis	Date/ Time	*	
Lab_ID	Identification of the laboratory performing the analysis	Text	7	See Table B

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
QC_Level	Level of analytical laboratory QC associated with the analysis (i.e., Certificate of Analysis)	Text	6	See Table B
Result_Basis	Wet or dry weight	Text	3	See Table B
Total_Or_Dissolved	This field indicates if the results related to this sample and method are expressed as total or dissolved. This field is applicable to samples analyzed for metals.	Text	3	See Table B
Dilution	Overall dilution of the sample aliquot. A value of one corresponds to nominal method conditions. Insert value of one for blanks, LCS, and LCSD. Dilution must be expressed as a whole number.	Number	Single	
Handling_Type	Type of leaching procedure (i.e., SPLP,TCLP, WET).	Text	10	See Table B
Handling_Batch	Unique laboratory identifier for a batch of samples prepared together for a leaching procedure (i.e., SPLP, TCLP, or WET preparation). Links samples with leaching blanks.	Text	12	
Leachate_Date	Leachate date (i.e., date for SPLP, TCLP, or WET preparation)	Date/ Time	*	
Percent_Moisture	Percent of sample composed of water. Enter for soil and sediment samples only.	Number	Single	
Method_Batch	Unique laboratory identifier for a batch of samples of similar matrices analyzed by one method and treated as a group for field QC purposes. Links the matrix spike and/or matrix spike duplicate or laboratory duplicates to associated samples. Note, the Method_Batch association may coincide with the Preparation_Batch association. The Method_Batch is specifically used to link the MS, MS/MSD, or DUP to associated samples.	Text	12	
Preparation_Batch	Unique laboratory identifier for a batch of sample aliquots prepared together for analysis by one method. Links samples with method blanks and laboratory control samples. Note, the Preparation_Batch association may coincide with the Method_Batch association. The Preparation_Batch is specifically used to link the Method Blank and LCS to associated samples.	Text	12	
Run_Batch	Unique identifier for a batch of analyses performed on one instrument under the control of one initial calibration and initial calibration verification. Links both the initial calibration and initial calibration verification to subsequently analyzed and associated continuing calibrations, field samples, and QC analyses. For GC/MS methods, the “Run_Batch” also links a BFB or DFTPP tune and the initial calibration and initial calibration verification standards to associated samples and method QC analyses. Even though methods 6010B and 6020 are treated as individual metals methods, all sample/metal method records reported under one initial calibration can use the same Run Batch ID. A different and unique Run Batch ID must be used with every new initial calibration. The identifier entered in this field links a particular sample/method/analysis type record to a set of associated initial calibration and initial calibration verification records from Table A2.	Text	12	

Field Name	Field Name Description	Field Type	Field Length	Standard Value List
Analysis_Batch	Unique laboratory identifier for a batch of analyses performed on one instrument and under the control of a continuing calibration or continuing calibration verification. Links the continuing calibration or calibration verification to subsequent, associated field sample and QC analyses. For GC/MS methods the "Analysis_Batch" also links the BFB or DFTPP tune and the continuing calibrations to associated samples and method QC analyses. Even though methods 6010B and 6020 are treated as individual metals methods, all sample/metal method records reported under one continuing calibration can use the same Analysis Batch ID. A different and unique Analysis Batch ID must be created with every new continuing calibration or continuing calibration verification. The identifier entered in this field links a particular sample/method/analysis type record to a set of associated continuing calibration records from Table A2.	Text	12	
Lab_Reporting_Batch	Unique laboratory identifier for a batch of samples including associated calibrations and method QC, reported as a group by the lab (i.e. lab work order #, log-in #, or SDG). Links all instrument calibrations, samples, and method QC reported as a group or SDG.	Text	12	
Lab_Receipt	Date the sample was received in the lab	Date/ Time	*	
Lab_Reported	Date the hardcopy data were reported by the lab	Date/ Time	*	

Note: Contains information related to laboratory sample and QC analyses (excluding calibrations and tunes), analytical methods, batching information, and sample preparation.

* Date/time format is: MM/DD/YYYY hh:mm where MM = month, DD = day, YYYY = four digits of the year, hh = hour in 24 hour format, and mm = minutes.

Table B: Standard Value List (SVL)

Field Name	Standard Value	Standard Value Description
Analysis_Type	DL	Dilution of the original sample
	DL2	Second dilution of the original sample
	DL3	Third dilution of the original sample
	DL4	Fourth dilution of the original sample
	RE	Reanalysis/reextraction of sample
	RE2	Second reanalysis/reextraction of sample
	RE3	Third reanalysis/reextraction of sample
	RE4	Fourth reanalysis/reextraction of the original sample
	RES	The initial or original sample.
Analyte_Name	Refer to QAPP and Project Library	Refer to QAPP and Project Library
Analyte_Type	IS	Internal standard as defined per CLP usage
	SPK	Spiked analyte
	SURR	Surrogate as defined as per CLP usage
	TIC	Tentatively identified compound for GC/MS analysis
	TRG	Target compound
Detection_Limit_Type	CRDL	Contract required detection limit
	IDL	Instrument detection limit
	MDA	Minimum detectable activity

Field Name	Standard Value	Standard Value Description
	MDL	Method detection limit
Handling_Type	WET	Wet leaching procedure
	SPLP	Synthetic Precipitation Leaching Procedure
	TCLP	Toxicity Characteristic Leaching Procedure
Lab_Qualifiers	*	INORG: Duplicate analysis was not within control limits
	*	ORG: Surrogate values outside of contract required QC limits
	+	INORG: Correlation coefficient for the method of standard additions (MSA) was less than 0.995
	A	ORG: Tentatively identified compound (TIC) was a suspected aldol-condensation product
	B	INORG: Value less than contract required detection limit but greater than or equal to instrument detection limit
	B	ORG: Compound is found in the associated blank as well as in the sample
	C	ORG: Analyte presence confirmed by GC/MS
	D	Result from an analysis at a secondary dilution factor
	E	INORG: Reported value was estimated because of the presence of interference
	E	ORG: Concentrations exceed the calibration range of the instrument
	H	Analysis performed outside method or client-specified holding time requirement
	J	Estimated value
	M	INORG: Duplicate injection precision was not met
	N	INORG: Spiked sample recovery was not within control limits
	N	ORG: Presumptive evidence of a compound
	P	ORG: Difference between results from two GC columns unacceptable (>25% Difference)
	S	Reported value was determined by the method of standard additions (MSA)
	U	Compound was analyzed for but not detected. Analyte result was below the _Reporting_Limit_Type.
	W	INORG: Post digestion spike was out of control limits
	X	Reserved for a lab-defined data qualifier
	Y	Reserved for a lab-defined data qualifier
	Z	Reserved for a lab-defined data qualifier
Lab_ID		List of contract laboratories. To be established by each contractor.
Matrix_ID	AIR	Air
	AQ	Water
	ASH	Ash
	BIOTA	Biological matter
	FILTER	Filter
	LIQUID	Non-aqueous liquid
	OIL	Oil
	SED	Sediment
	SLUDGE	Sludge
	SO	Soil
	SOLID	Non-soil/sediment solid
	TISSUE	Tissue
	WASTE	Waste
Preparation_Type	3005A	Acid Digestion of Waters for Total Recoverable or Dissolved Metals by FLAA or ICP
	3010A	Acid of Aqueous Samples and Extracts for Total Metals by FLAA or ICP

Field Name	Standard Value	Standard Value Description
	3015	Microwave Assisted Acid Digestion of Aqueous Samples and Extracts
	3020A	Acid Digestion of Aqueous Samples and Extracts for Total Metals by GFAA
	3031	Acid Digestion of Oils for Metals Analysis by AA or ICP
	3050B	Acid Digestion of Sediments, Sludges, and Soils
	3051	Microwave Assisted Acid Digestion of Sediments, Sludges, Soils and Oils
	3052	Microwave Assisted Acid Digestion of Siliceous and Organically Based Matrices
	3060A	Alkaline Digestion for Hexavalent Chromium
	3510C	Separatory Funnel Liquid-Liquid Extraction
	3520C	Continuous Liquid-Liquid Extraction
	3535	Solid Phase Extraction
	3540C	Soxhlet Extraction
	3541	Automated Soxhlet Extraction
	3545	Pressurized Fluid Extraction
	3550B	Ultrasonic Extraction
	3560	Supercritical Fluid Extraction of Total Recoverable Petroleum Hydrocarbons
	5030B	Purge and Trap for Aqueous Samples
	5035	Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples
	7470A	Acid digestion of waters for Mercury analysis
	7471A	Acid digestion of soils and solids for Mercury analysis
	Gen Prep	Generic preparation type when a preparation method ID does not exist (used mostly for general chemistry methods)
QC_Level	COA	Certificate of Analysis (accuracy and precision, no calibration)
	COACAL	Certificate of Analysis (accuracy and precision including calibration)
QC_Type	MB	Analytical control consisting of all reagents and standards that is carried through the entire procedure (Method Blank)
	CV	(Calibration Verification) Analytical standard run at a specified frequency to verify the calibration of the analytical system
	CCV	(Continuing Calibration Verification) Analytical standard run every 12 hours to verify the calibration of the GC/MS system
	DUP	A second aliquot of a sample that is treated the same as the original aliquot to determine the precision of the method
	EB	Field equipment rinsate
	FB	(Field blank) Analyte-free water or solvent brought to the field in sealed containers and transported to lab with sample containers
	FD	Duplicate sample taken from a field sample
	IC	(Initial Calibration) Analysis of analytical standards for a series of different specified concentrations
	ICV	(Initial Calibration Verification) Analytical standard run at a specified frequency to verify the accuracy of the initial calibration of the analytical system
	IPC	(Instrument Performance Check) Analysis of DFTPP or BFB to evaluate the performance of the GC/MS system
	LCS	(Laboratory Control Sample) A control sample of known composition
	LCSD	(Laboratory Control Sample Duplicate) A duplicate control sample of known composition
	MS	(Matrix Spike) Aliquot of a matrix spiked with known quantities and subjected to the entire analytical procedure to measure recovery
	MSD	(Matrix Spike Duplicate) A second aliquot of the same matrix as the matrix spike that is spiked in order to determine the precision of the method
	PB	(Preparation Blank) Analytical control containing distilled, deionized water and reagents, and subjected to entire analytical procedure

Field Name	Standard Value	Standard Value Description
	SB	(Storage Blank) Aliquot of analyte-free water or solvent stored with the samples as a check on contamination from the storage process
	TB	(Trip Blank) Analyte free water transported with sample bottles prior to and after sample collection
Reporting_Limit_Type	CRDL	Contract required detection limit
	CRQL	Contract required quantitation limit
	PQL	Practical quantitation limit
	SQL	Sample quantitation limit
	RDL	Reportable detection limit
Result_Basis	DRY	Result was calculated on a dry weight basis
	WET	Result was calculated on a wet weight basis
Result_Units*	ug/L	Micrograms per liter
	mg/L	Milligrams per liter
	ug/Kg	Micrograms per kilogram
	mg/Kg	Milligrams per kilogram
	pg/L	Picograms per liter
	ng/Kg	Nanograms per kilogram
Total_Or_Dissolved	DIS	Dissolved
	TOT	Total

*Additional result units are acceptable by adding these to the standard value table.

ADaPT STANDARD VALUES FOR METHODS

A method name must exist in standard value table before it can be added to a project library. The project library controls what is accepted in the EDD. Table C lists all the methods built into the ADaPT standard value table. Additional methods can be added to this table if necessary. If a particular method specified in the QAPP or used by the laboratory is not listed in this table, it must be added to the standard value table before that method can be built into a project library. Methods added to a project library become standard values for the Lab Reference Method ID field (method field) in any EDD processed through the error checker when selecting that project library as reference.

STANDARD VALUES FOR ANALYTES

A CAS number and analyte name must exist in the standard value table before it can be added to a method in a project library. The ADaPT standard value table contains records for several thousand compound names and their CAS numbers. Additional analyte name records can be added if necessary. Analyte names and CAS numbers added to a method within a project library become standard values for the Analyte Name and Client Analyte ID (CAS number) fields in any EDD processed through the error checker when selecting that project library as reference.

Table C: Standard Values for Analytical Methods

Method	Description
524.2	Volatile Organic Compounds by GC/MS in Drinking Water
6010B	Metals by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Ag	Silver by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Al	Aluminum by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-As	Arsenic by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-B	Boron by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Ba	Barium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Be	Beryllium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Ca	Calcium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Cd	Cadmium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Co	Cobalt by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Cr	Chromium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Cu	Copper by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Fe	Iron by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-K	Potassium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Li	Lithium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Mg	Magnesium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Mn	Manganese by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Mo	Molybdenum by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Na	Sodium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Ni	Nickel by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-P	Phosphorus by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Pb	Lead by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Sb	Antimony by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Se	Selenium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Sn	Tin by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Sr	Strontium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-TCLP	TCLP Metals by Inductively Coupled Plasma-Atomic Emission Spectroscopy

Method	Description
6010B-Tl	Thallium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-V	Vanadium by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6010B-Zn	Zinc by Inductively Coupled Plasma-Atomic Emission Spectroscopy
6020	Metal by Inductively Coupled Plasma/Mass Spectrometry
7041	Antimony by Graphite Furnace Atomic Absorption
7060A	Arsenic by Graphite Furnace Atomic Absorption
7081	Barium by Graphite Furnace Atomic Absorption
7091	Beryllium by Graphite Furnace Atomic Absorption
7131A	Cadmium by Graphite Furnace Atomic Absorption
7191	Chromium by Graphite Furnace Atomic Absorption
7201	Cobalt by Graphite Furnace Atomic Absorption
7211	Copper by Graphite Furnace Atomic Absorption
7381	Iron by Graphite Furnace Atomic Absorption
7421	Lead by Graphite Furnace Atomic Absorption
7461	Manganese by Graphite Furnace Atomic Absorption
7470A	Mercury by Graphite Furnace Atomic Absorption
7471A	Mercury by Graphite Furnace Atomic Absorption
7481	Molybdenum by Graphite Furnace Atomic Absorption
7521	Nickel by Graphite Furnace Atomic Absorption
7740	Selenium by Graphite Furnace Atomic Absorption
7761	Silver by Graphite Furnace Atomic Absorption
7841	Thallium by Graphite Furnace Atomic Absorption
7911	Vanadium by Graphite Furnace Atomic Absorption
7951	Zinc by Graphite Furnace Atomic Absorption
8011	1,2-Dibromoethane and 1,2-Dibromo-3-chloropropane by Microextraction and GC
8015B	Non-halogenated organics by GC using FID
8015B DRO	Diesel Range Organics by GC using FID
8015B Extractable TPH	Extractable Petroleum Hydrocarbons as Gasoline
8015B GRO	Gasoline Range Organics by GC using FID
8015B Purgeable TPH	Purgeable Petroleum Hydrocarbons as Diesel and Motor Oil
8021B	Aromatic and Halogenated Volatiles by GC using PID/ECD
8081A	Organochlorine Pesticides by GC using ECD
8082	Polychlorinated Biphenyls (PCBs) by GC using ECD or ELCD
8082 PCB Congeners	Polychlorinated Biphenyl Congeners by GC using ECD or ELCD
8141A	Organophosphorus Compounds by GC
8151A	Chlorinated Herbicides by GC using Methylation or Pentafluorobenzylation
8260B	Volatile Organic Compounds by GC/MS
8270C	Semi-Volatile Organic Compounds by GC/MS
8270C-SIM	Semi-Volatile Organic Compounds by GC/MS SIM
8280A	Polychlorinated Dibenzo-p--Dioxins and Polychlorinated Dibenzofurans
8290	Polychlorinated Dibenzodioxins and Polychlorinated Dibenzofurans
8310	Polynuclear Aromatic Hydrocarbons by HPLC
8330	Nitroaromatics and Nitramines (Explosives) by HPLC
9040	pH Electrometric Measurement
9045	Soil and Waste pH
9056	Determination of Inorganic Anions by Ion Chromatography

Method	Description
300.0	Determination of Inorganic Anions by Ion Chromatography
353.2	Determination of Total Nitrate-Nitrite by Colorimetry
160.1	Total Dissolved Samples
310.1	Alkalinity
415.1	Total Organic Carbon by combustion or oxidation
DHS Luft/7420	Organic lead
410.4	Chemical Oxygen Demand by Colorimetry
SM 3500-Fe D#4	Determination of Iron by Colorimetry
SM 4500-CO2 D	Carbon Dioxide
351.2	Total Kjeldahl Nitrogen
7196A	Hexavalent Chromium (Colorimetric)

Note: Additional methods or variations on method names can be added to the standard value table.

Table D1 (1 of 2): Required Fields in the Analytical Results Table for GC/MS, GC, and HPLC Methods

	GC/MS Methods			GC and HPLC Methods		
Field	Regular Sample*	MS/MSD	Method Blank, LCS/LCSD	Regular Sample [a]	MS/MSD	Method Blank, LCS/LCSD
Client_Sample_ID	X	X	X	X	X	X
Lab_Analysis_Ref_Method_ID	X	X	X	X	X	X
Analysis_Type	X	X	X	X	X	X
Lab_Sample_ID	X	X	X	X	X	X
Lab_ID	X	X	X	X	X	X
Client_Analyte_ID	X	X	X	X	X	X
Analyte_Name	X	X	X	X	X	X
Result	X	X	X	X	X	X
Result_Units	X	X	X	X	X	X
Lab_Qualifiers	Q	Q	Q	Q	Q	Q
Detection Limit	X	X	X	X	X	X
Detection_Limit_Type	X	X	X	X	X	X
Retention_Time	T		T			
Analyte_Type	X	X	X	X	X	X
Percent_Recovery	S	R	R	S	R	R
Relative_Percent_Difference		D	D		D	D
Reporting_Limit	X	X	X	X	X	X
Reporting_Limit_Type	X	X	X	X	X	X
Reportable_Result	X	X	X	X	X	X

X Required Field
D Required field for spiked compounds in the LCSD and MSD only
Q Required field if laboratory has qualified result
R Required field if Analyte_Type = “SPK” or “SURR”
S Required field for surrogate compounds only
T Required field for tentatively identified compounds by GC/MS only
[a] Also includes Equipment Blanks, Field Blanks, and Trip Blanks.

Table D1 (2 of 2): Required Fields in the Analytical Results Table for ICAP, AA, and IC Methods

	ICAP and AA Methods			IC and Wet Chemistry Methods		
Field	Regular Sample*	Sample Duplicate, MS/MSD	Method Blank, LCS/LCSD	Regular Sample*	Sample Duplicate MS/MSD	Method Blank, LCS/LCSD
Client_Sample_ID	X	X	X	X	X	X
Lab_Analysis_Ref_Method_ID	X	X	X	X	X	X
Analysis_Type	X	X	X	X	X	X
Lab_Sample_ID	X	X	X	X	X	X
Lab_ID	X	X	X	X	X	X
Client_Analyte_ID	X	X	X	X	X	X
Analyte_Name	X	X	X	X	X	X
Result	X	X	X	X	X	X
Result_Units	X	X	X	X	X	X
Lab_Qualifiers	Q	Q	Q	Q	Q	Q
Detection Limit	X	X	X	X	X	X
Detection_Limit_Type	X	X	X	X	X	X
Retention_Time						
Analyte_Type	X	X	X	X	X	X
Percent_Recovery		S	S		S	S
Relative_Percent_Difference		R	R		R	R
Reporting_Limit	X	X	X	X	X	X
Reporting_Limit_Type	X	X	X	X	X	X
Reportable_Result	X	X	X	X	X	X

X Required field
Q Required field if laboratory has qualified result
R Required field for spiked compounds in LCSD or MSD, or target compounds in the Sample Duplicate only
S Required field if Analyte_Type = "SPK"
* Also includes Trip Blanks, Equipment Blanks, and Field Blanks

Table D2: Required Fields in the Laboratory Instrument Table

	GC/MS Tunes		Initial Calibration				Initial Calibration Verification				Calibration Verification, Continuing Calibration
Field	VOA	SVOA	GC/MS	GC HPLC	ICP/AA	IC*	GC/MS	GC HPLC	ICP/AA	IC*	All Methods
Instrument_ID	X	X	X	X	X	X	X	X	X	X	X
QC_Type	X	X	X	X	X	X	X	X	X	X	X
Analyzed	X	X	X	X	X	X	X	X	X	X	X
Alternate_Lab_Analysis_ID	X	X	X	X	X	X	X	X	X	X	X
Lab_Analysis_ID	X	X					X	X	X	X	X
Lab_Analysis_Ref_Method_ID	X	X	X	X	X	X	X	X	X	X	X
Client_Analyte_ID	X	X	X	X	X	X	X	X	X	X	X
Analyte_Name	X	X	X	X	X	X	X	X	X	X	X
Run_Batch	X	X	X	X	X	X	X	X	X	X	X
Analysis_Batch	C	C									X
Lab_Reporting_Batch	X	X	X	X	X	X	X	X	X	X	X
Percent_Relative_Standard_Deviation			X	X							

Field	GC/MS Tunes		Initial Calibration				Initial Calibration Verification				Calibration Verification, Continuing Calibration
	VOA	SVOA	GC/MS	GC HPLC	ICP/AA	IC*	GC/MS	GC HPLC	ICP/AA	IC*	All Methods
Correlation_Coefficient			B	B	X	X					
Relative_Response_Factor			X				X				M
Percent_Difference							X	X	X	X	X
Peak_ID_01	X	X									
Percent_Ratio_01	X	X									
Peak_ID_02	X	X									
Percent_Ratio_02	X	X									
Peak_ID_03	X	X									
Percent_Ratio_03	X	X									
Peak_ID_04	X	X									
Percent_Ratio_04	X	X									
Peak_ID_05	X	X									
Percent_Ratio_05	X	X									
Peak_ID_06	X	X									
Percent_Ratio_06	X	X									
Peak_ID_07	X	X									
Percent_Ratio_07	X	X									
Peak_ID_08	X	X									
Percent_Ratio_08	X	X									
Peak_ID_09	X	X									
Percent_Ratio_09	X	X									
Peak_ID_10		X									
Percent_Ratio_10		X									
Peak_ID_11		X									
Percent_Ratio_11		X									
Peak_ID_12		X									
Percent_Ratio_12		X									
Peak_ID_13		X									
Percent_Ratio_13		X									

X Required field (some fields are not applicable to some General (Wet) Chemistry tests)
B Required field if reporting best fit
C Required field if BFB or DFTPP associated with a continuing calibration only
M Required field for GC/MS continuing calibration only
*IC Includes Ion Chromatography and Classical or Wet Chemistry methods. Methods such as pH, Conductivity, and others do not use traditional calibration procedures, therefore some fields marked as a required field under the “IC” column do not apply for these methods.

Table D3: Required Fields in the Sample Analysis Table

Field	GC, GC/MS, HPLC Methods		ICAP and AA Methods		IC and Wet Chemistry Methods	
	Method Blanks, LCS/LCSD	Regular Samples*, Sample Duplicate, MS/MSD	Method Blanks, LCS/LCSD	Regular Samples*, Sample Duplicate, MS/MSD	Method Blanks, LCS/LCSD	Regular Samples*, Sample Duplicate, MS/MSD
Client_Sample_ID	X	X	X	X	X	X
Collected		X		X		X
Matrix_ID	X	X	X	X	X	X
Lab_Sample_ID	X	X	X	X	X	X
QC_Type	X	Q	X	Q	X	X
Shipping_Batch_ID		X		X		X
Temperature		X				X
Lab_Analysis_Ref_Method_ID	X	X	X	X	X	X
Preparation_Type	X	X	X	X	X	X
Analysis_Type	X	X	X	X	X	X
Prepared	A	A	X	X	N	N
Analyzed	X	X	X	X	X	X
Lab_ID	X	X	X	X	X	X
QC_Level	X	X	X	X	X	X
Results_Basis		S		S		S
Total_Or_Dissolved			W	W		
Dilution	X	X	X	X	X	X
Handling_Type	L	L	L	L	L	L
Handling_Batch	L	L	L	L	L	L
Leachate_Date	L	L	L	L	L	L
Percent Moisture		S		S		S
Method_Batch	X	X	X	X	X	X
Preparation_Batch	X	X	X	X	X	X
Run_Batch	C	C	C	C	C	C
Analysis_Batch	C	C	C	C	C	C
Lab_Reporting_Batch	X	X	X	X	X	X
Lab_Receipt		X		X		X
Lab_Reported	X	X	X	X	X	X

X Required field
A Required field for samples prepared by methanol extraction
C Required field if Instrument Calibration Table (A2) is included in EDD
L Required field if analysis performed on SPLP, TCLP, or WET extracts
N Required field only for samples that require preparation before analysis
Q Required field for Sample Duplicate, MS, and MSD only
S Required field if “Matrix_ID” = “SO” or “SED”
W Required field for aqueous samples only
* Includes Trip Blanks, Equipment Blanks, and Field Blanks

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Attachment E
Scoping Meeting Minutes

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Remedial Investigation/Feasibility Study
Waikane Valley Impact Area
Minutes of Scoping Meeting
20 April 2009

The meeting was conducted at NAVFAC Pacific Headquarters building at Makalapa Drive, Pearl Harbor, Hawaii. Introductions were made around the table and a signup sheet was circulated (Attachment 1). Mr. Robert Nore, Project Manager for USA Environment, Inc., gave the attached presentation (Attachment 2). Issues discussed and decided during the meeting are addressed in the following paragraphs.

Site Name: The Army Corps of Engineers calls their FUDS site Waikane Valley Training Area. In order to distinguish the Marine Corps property, the 187-acre Marine Corps site will be called Waikane Valley Impact Area.

Transport of Munitions Debris off site: USAE would like to use Marine Corps helicopters to airlift MD off site, possibly as a training exercise. They used helicopters for this purpose during the 1976 and 1984 cleanups. Resolution of this issue will require a future meeting with MCB Hawaii and contacts with the proper authorities.

ESS Submittal: Scope calls for ESS Submittal before submittal of Work Plan. Mr. Nore indicated that this approach is unworkable. If the ESS is submitted to NOSSA before the WP is done, there's no guarantee that by the time the ESS is approved it will be the same as the WP. A lot of changes come up in the last review of the WP. The uncertain duration of NOSSA review is another thing to keep in mind during development of the WP and ESS. Navy indicated they know the ESS is going to have to wait for completion of the Work Plan before submittal.

Vegetation removal: Need to use chain saws and weedwhackers in order to gain complete access to the site for surface clearance. Mr. Nore asked if it would be acceptable to use weedwhackers and chain saws to cut vegetation. There was no objection to such use as long as archaeological features were not disturbed and erosion was not increased by the action.

Vegetation cuttings: There was concern about what to do with the cuttings. USAE plans to move cut vegetation out of the way as we progress through the grids. Navy indicated that USAE should propose how we would minimize impacts on erosion.

Since this was the first scoping meeting for the MRS program, Mr. Hosokawa introduced the QAPP process and spent considerable time discussing the objective of the process, which is to establish agreement on project uncertainties at the beginning of a project rather than later on. Ms. Saboda suggested that we develop problem statements rather than spend too much time is discussing details. However, Mr. Hosokawa indicated that Mr. Nore could continue with the presentation.

Blow in Place (BIP): Mr. Nore indicated that the UXO personnel are prevented from moving items identified as UXO and must BIP. He asked Dan Miller, a USAE employee with UXO qualifications, to explain how a decision is made to blow in place. Mr. Miller first explained that during the SI we were unable to handle the MEC items to positively determine whether they were practice or HE rounds, and therefore had to assume they were UXO. During the RI we will be able to more reliably determine whether they are practice or UXO, but for the 3.5-inch rockets there is no way to tell, so you're taking a chance by picking it up. He also explained that the rockets used at the site were meant for anti-tank use, and produce a copper slug that penetrates the armor. He indicated he would sandbag the UXO item and use a 19-gram jet perforators to penetrate the item. If around a cultural feature, we could place the perforator so as to try to separate the fuze from the main charge without detonating the main charge, and then move the items away from the feature to detonate the two items. We would still have to sandbag the item to direct the blast away from the cultural feature. Deeming an item acceptable to move requires more than one person to make the decision. X-Ray procedures will not work on the site. The mitigation for demolition holes is to fill them in.

Engineering controls: USAE don't see the need for engineering controls except for protection of cultural features. Carrying sandbags through the steep terrain to the site is a very difficult task, and we would want to use helicopters if possible. If sandbags were brought in we would possibly be able to leave the sand if it wasn't visible when we left the site. We discussed using local labor to haul sandbags up to the site, and how treacherous the terrain is. The sandbags are over 40 pounds each and nearly 50 sandbags are required to provide the proper engineering controls.

Confirmation sampling of detonation points: Post sampling of soil in detonation holes can be done if deemed necessary, but studies have found that most of the explosives are consumed in the detonation. In order to satisfy public concerns we are probably going to have to do pre- and post-detonation sampling of detonations. The number of samples needed to satisfy the public was not decided on.

Sufficiency of RI scope: In answer to questions from DOH, Mr. Nore indicated that the surface clearance is conservative enough to ensure that the entire target areas will be characterized. If MEC is still being found when we reach the edges of the target areas, we're going to recommend proceeding further. For subsurface, we're looking at 8 grids total, one at the center of each target and one probably at the lower end of the target to see what's migrated downward. Subsurface investigation doesn't need to be conducted below the target areas because we didn't find any surface MEC below the targets. By sending teams in to clear the grids to depth, we will know how long it takes and will then be able to put a cost on an eventual clearance.

Equipment limitations: The limitations of detection equipment on slopes were discussed. USAE contends that whatever detection equipment works at the bottom of the site will work at the top of the site. The slope is a somewhat limiting factor as detectors detect vertically, but they still work on the slope. What is important is that we use the best available technology to try to find MEC at the site.

Net Explosive Weight (NEW): How much NEW can be detonated without upsetting the public? This is a potential problem statement for the MEC QAPP.

USACE Removal Action: The Corps of Engineers Waikane FUDS site has gotten past the EE/CA phase and is moving ahead with removal action phase.

Munitions Debris Management: Mr. Nore indicated that we would like secure storage space either on MCB Hawaii or at a private location so that we can store MD in a CONEX. The difficulty of transporting off site was discussed, and USAE indicated that MD contains no energetic material and is therefore no hazard to the public. We are looking at the possibility of delivering the MD to a local demil company. If one is not available the MD will be shipped to CONUS for destruction.

Archaeological Monitors: We can declare the archaeologists as essential team members so that they can be with the MEC team at all times. Navy indicated that the archaeologists need to be on hand before and after excavations. This is another problem statement that needs to be worked out during work plan development. The public would feel we are doing the best we can if we have constant archaeological presence on site watching the work.

Munitions Constituents: We've proposed 35 discrete samples, but we'll probably want a couple of water samples in Waikane stream analyzed for copper and lead. Are we going to test for anything else? Our initial testing was based on the chemicals that were expected from the munitions used at the site, and copper and lead were the only chemicals found to exceed PALs in the soil.

Worksheet 10 Problem Definition: Copies of the draft worksheets were handed out to the attendees, and Ms. Shacat began the process of seeking consensus on problem statements. Various problem statements offered are as follows:

Discussion:

Mr. Mow said we must address who's at risk (the receptor), and we've implied that Waikane Stream is at risk because we've set our action level at 200 (for lead). Is the contamination from the target area getting into the stream? If the answer is no, why are we at 200 for our action level? If there are no ecological receptors, is the 200 PPM level appropriate? He suggested taking discrete samples between the target areas and the stream?

His question for the target area decision unit was whether we want to use MI samples or XRF, because we are clearing to unrestricted residential use scenario because someone wants to build a residence there someday.

Mr. Nore indicated that the target nearest the copper/lead exceedance samples can be extended to encompass the sample locations.

Mr. Mow on stream sampling: Your results can go all over the place so you stay away from water samples and instead do sediment sampling or soil near the stream. We need to use discrete sampling between the exceedance sample locations and the stream.

Problem statement for entire site: Do the levels of copper and lead on the 187 acres present a risk to human health and the ecology?
Problem statement for target areas: Do the target areas have levels of copper and lead that exceed residential use scenarios?
Problem statement for stream: Do the levels of copper and lead in the target areas extend beyond the target areas?
Problem Statement for cultural deposits: Will subsurface cultural deposits be affected by intrusive activity such as subsurface sampling?

Discussion: The format of the conceptual site model will be important in conveying the pathways to the public. Mr. Hosokawa requested a pictorial CSM.

Groundwater issues discussion: Conditions in Hawaii are not conducive for heavy metals to leach through the soils easily. Since we didn't get explosives analysis during the SI, there is no reason to expect explosives migration to groundwater. This discussion needs to be made in the QAPP.

Project Decision Conditions: Mr. Hosokawa asked if we have enough information from the SI to do a baseline ecological risk assessment. He is interested in conducting the BERA now in order to eliminate the eco-risk. Ms. Ning Li answered that there may be enough information but wanted to get with her risk assessor. If BERA says there's no risk, we don't have to characterize the area near the stream. There is no reason to suspect that there is a problem with aquatic receptors for copper and lead. Mr. Hosokawa asked that USAE provide potential costs for the BERA based on terrestrial receptors. Mr. Nore pointed out that the BERA wasn't in the scope.

Discussion of Stream vs. Sediment sampling: A long discussion going back and forth. Mr. Mow stressed again the dangers of water sampling, and suggested that a few sediment samples would be more appropriate. It was agreed that sediment sampling could be justified to the public, as the sediment would be the source of transport into the water.

IF/THEN statements: If you have exceedance of lead and copper in the target area, you have to do a human health risk assessment and a further action. The if/then statement in the handout was agreed to be applicable to all the problem statements, except change "potential or existing" to "unacceptable" and replace "MC" with "copper and lead".

If future use scenario is residential the cleanup level for lead is 400 ppm. The question is whether the 200 level comes into play.
We will be using EPA Regional screening levels. Not PRGs anymore but RSLs.

What type of data is needed? In target area area, surface and subsurface data is needed. DOH is used to 2-4 feet for subsurface. DOH suggested taking a look at XRF sampling option, which requires gridding of the target area and is discrete surface sampling at many points throughout. It was agreed that at the least the locations where exceedances were found needed to be samples. Going to the map the group discussed the need to establish decision units at the heaviest concentrations of MEC for MI sampling. The small arms target was small enough to merit a single unit and the other three ranges should be set up as three DUs each. It was also agreed that only 3 replicate samples would be taken, and that the samples would not be ground. The box for one of the target areas would be extended to include the exceedances. The exceedance locations will now be within a DU and will be MI sampled. If the MI sample within the exceedance areas comes up below PALs we go home. We explain to the public that we resampled the area and the exposure concentration was not at a level that posed a risk.

The question came up as to whether the stream is a DU. DOH suggested that it was not. You're taking samples along the stream but it's not like an MI sample. After discussion it was agreed to consider the stream as a DU so that MI samples can be taken. It would be easier to explain to public if all samples were MI. The Navy indicated that they wanted to ask their sediment experts as to whether MI is appropriate.

The MEC QAPP issue was discussed and the group tried to establish a date for a follow-up scoping meeting. The group wanted to establish a kickoff scoping meeting for MEC QAPP via a May 1 conference call at 0800 Hawaii time. After the conference call USAE would need 2 weeks to revise the worksheets and a second scoping meeting was tentatively scheduled for 19 and 20 May from 0900-1500 both days.

In the afternoon, the DOH and MCB Kaneohe attendees departed, and the remaining project team continued to discuss soil sampling, making significant progress in deciding on types and amounts of soil samples:

The small arms target area of concern (AOC) will be a single decision unit, from which 3 replicate MI samples will be taken. The remaining 3 target AOCs will each be divided into 3 decision units for MI sampling purposes (upper, middle, and lower DUs). The middle of these 3 AOCs will be enlarged to incorporate the locations of the 4 samples which exceeded PALs during the SI.

Two discrete subsurface samples will be taken in each target decision unit, one at 24 inches and one down to 36 inches if possible.

Waikane Stream will be divided into upstream, middle, and downstream decision units, and an MI sediment sample will be taken from each DU. Rationale will be provided for not conducting surface water samples.

Robert Nore, P.E.
Project Manager
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256-684-9791

Waikane Valley Impact Area RI/FS Scoping Meeting Attendance List

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Scoping Meeting

Waikane Valley
Training Area

Remedial
Investigation/
Feasibility Study

20 April 2009

Agenda

- Introductions
- Purpose of Meeting
- Site Inspection Results
- RI/FS Scope & Objectives
- MEC Issues
- MC Issues
- EE/CA Alternative
- Schedules

Purpose of Meeting

- Coordinate with stakeholders
- Develop Problem Statement
- Formulate Project Quality Objectives
- Basis for QAPP Worksheets 9, 10, 11, 15, and 17

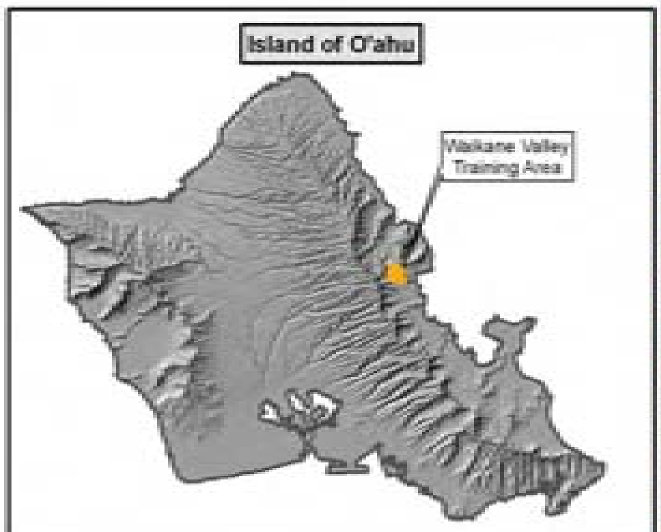
Acronyms

RI/FS	Remedial Investigation/Feasibility Study
MEC	Munitions and Explosives of Concern
MC	Munitions Constituents
EE/CA	Engineering Evaluation/Cost Analysis
QAPP	Quality Assurance Project Plan
WVTA	Waikane Valley Training Area
MD	Munitions Debris
UXO	Unexploded Ordnance
SI	Site Inspection
HEAT	High Explosive Anti-Tank
ESS	Explosives Safety Submission
BIP	Blow in Place

Site History

- WVTA originally consisted of 1,061 acres in leases.
- Used by U.S. military from early 1940's until 1976.
- Leases terminated in 1976.
- Surface cleared by U.S. Marine Corps in 1976 and 1984.
- Removed 40,000 lbs of MD and over 700 UXO's.
- Reports stated that 187-acre parcel could never be certified free of UXO.
- Government acquired title to 187 acres in 1989.
- Fencing of boundary completed in 1992.
- Currently managed by U.S. Marine Corps as "other than operational range".

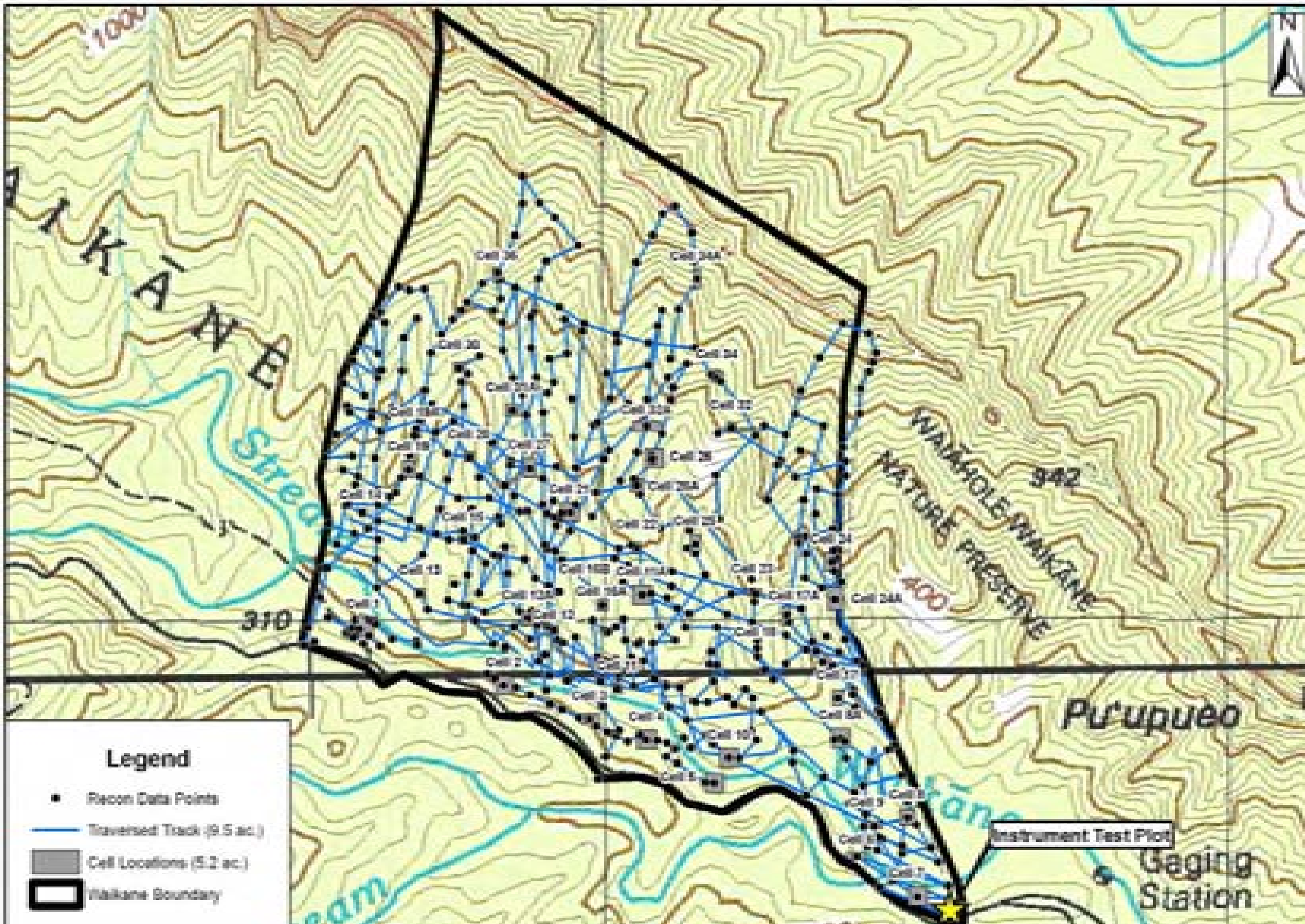
Location Map



Site Inspection Activities

- SI conducted in October 2008 over 187 acre site.
- Visual reconnaissance of 9.55 acres in transects and 5.2 acres within 42 cells.
- Collected 35 composite soil samples in lower elevations.
- Collected 10 discrete soil samples at MEC locations.

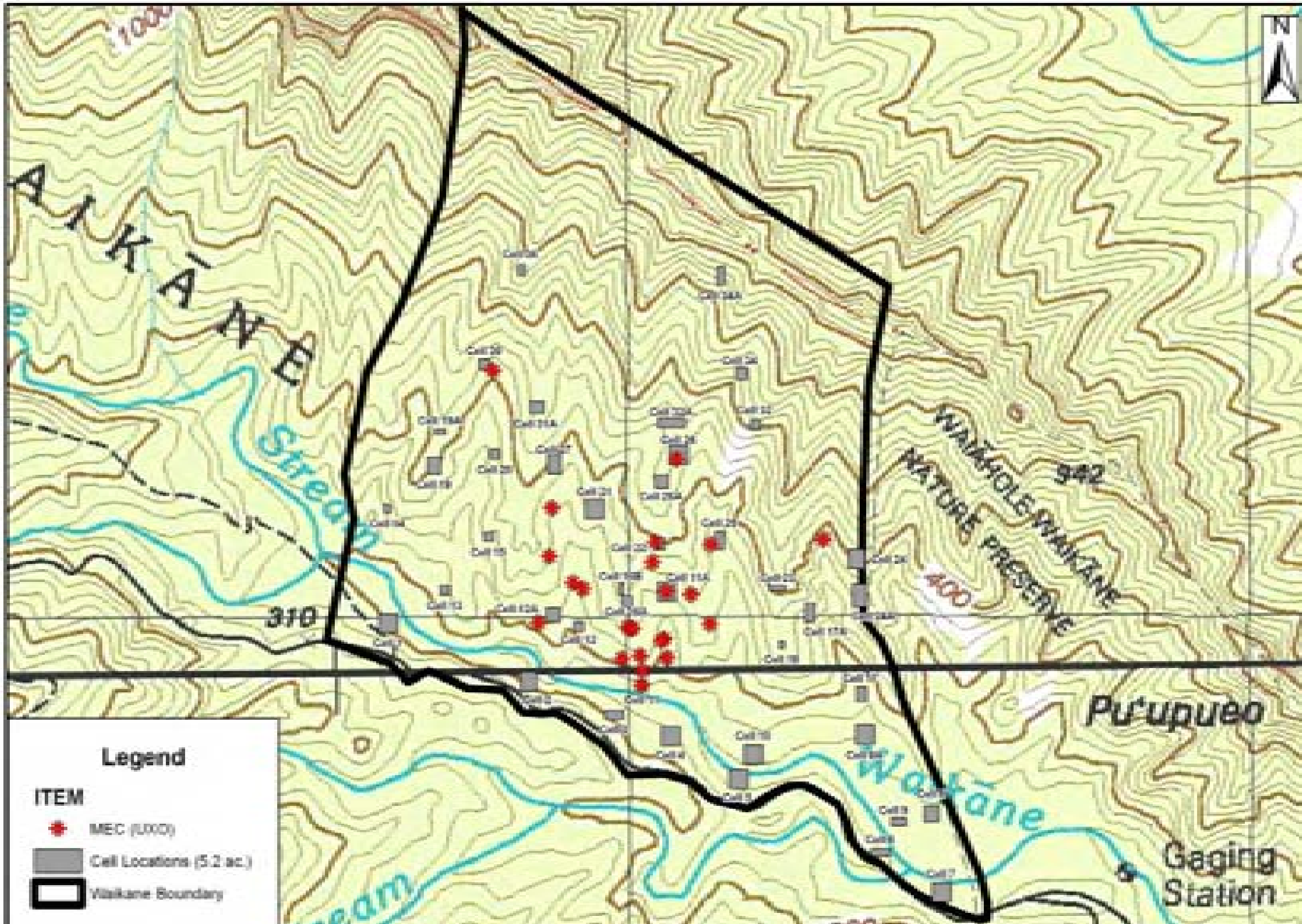
Recon Overview



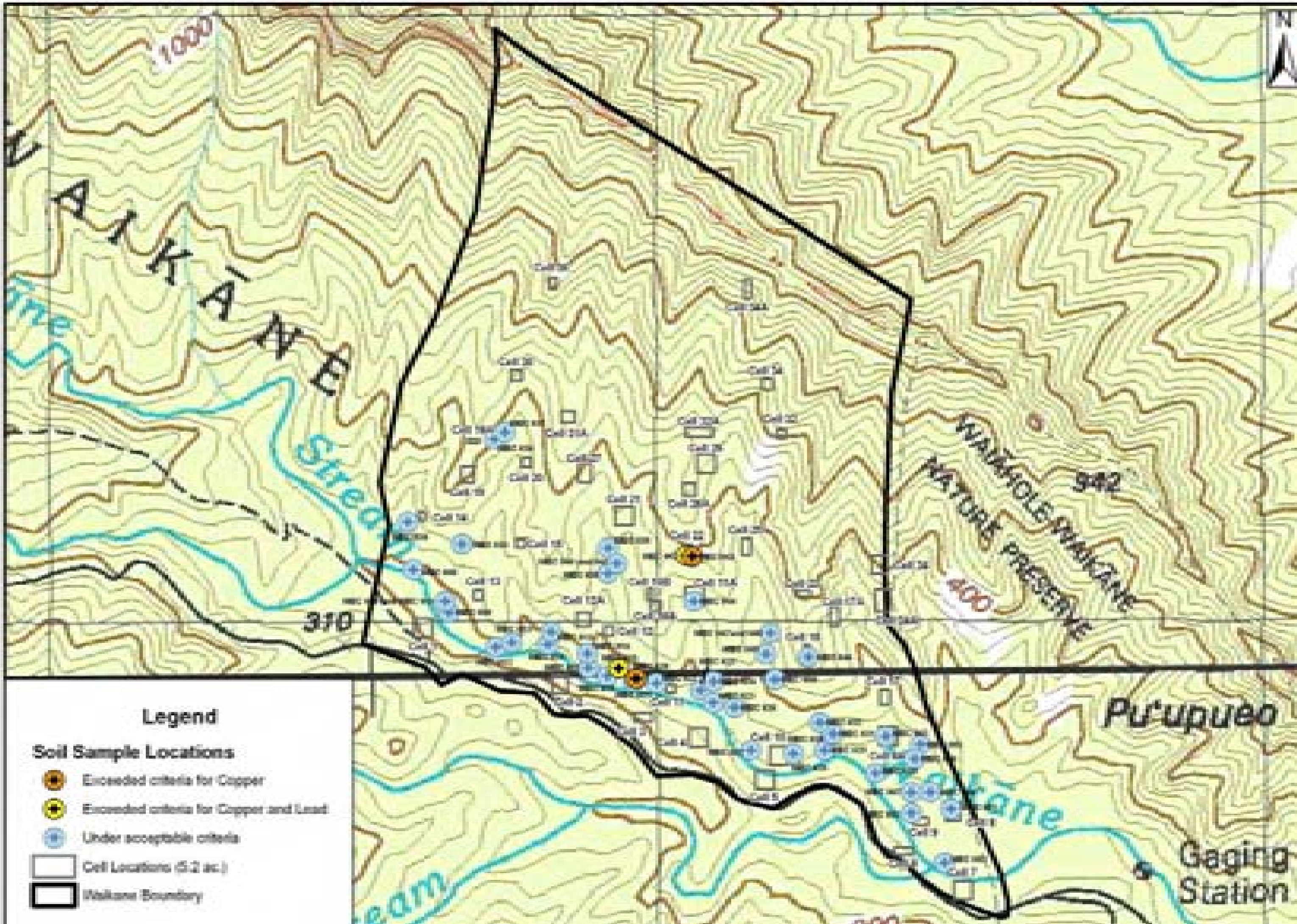
SI Findings

- Identified 70 UXO items
  - 66 3.5-inch HEAT Rockets
  - one 2.36-inch HEAT Rocket
  - 3 HEAT rifle grenades
- Identified copper and lead as chemicals of potential concern in 4 soil samples
- Identified four specific target areas.

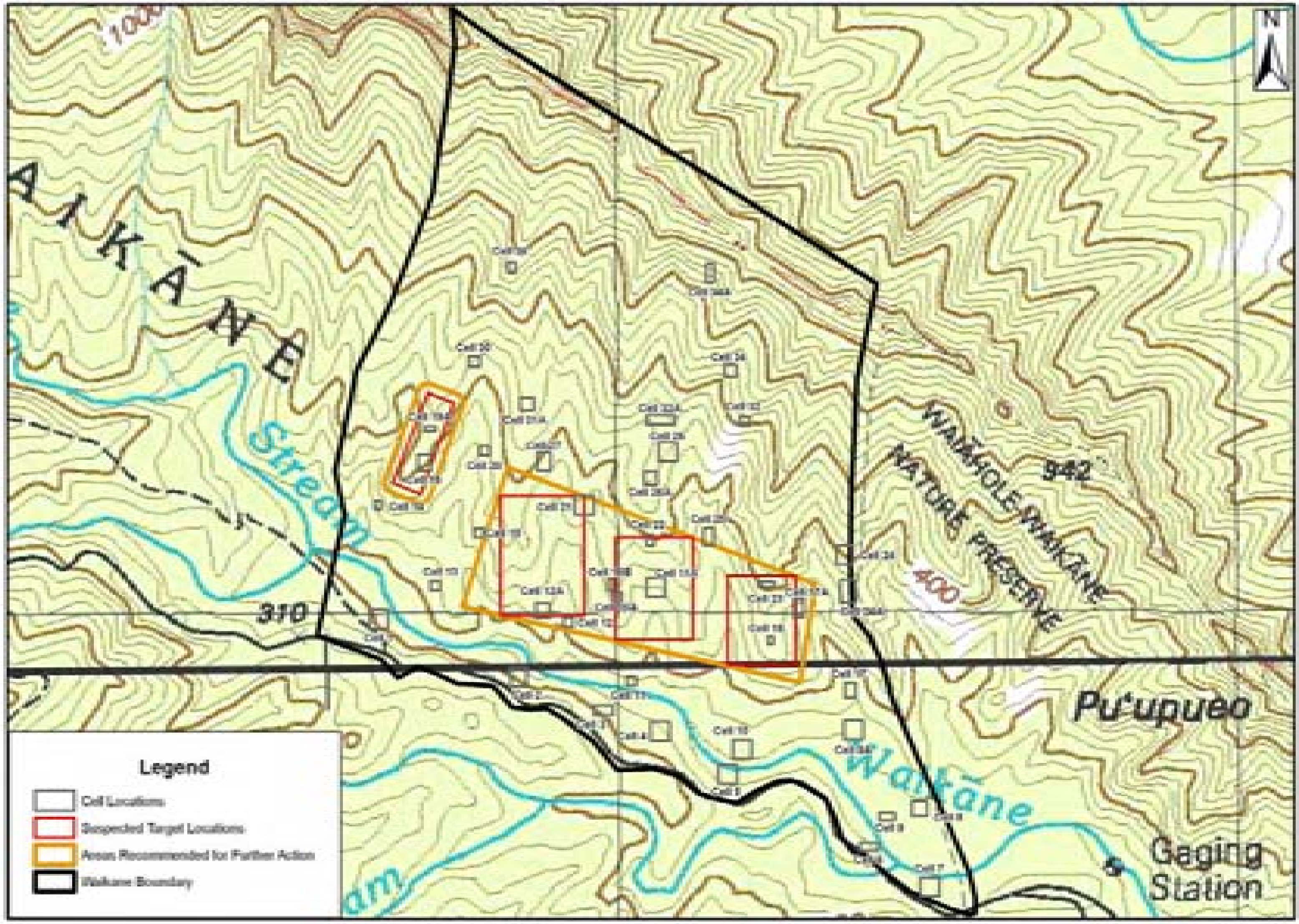
UXO Surface Findings



Soil Sampling



Conceptual Site Model



RI/FS Scope

- Develop Work Plan, ESS and MC QAPP
- Surface Clearance of Target Area (44 acres)
- Subsurface Investigation of Grids in Target Area (2 acres)
- Disposal of MEC and MD
- MC Sampling and Analysis (35 discrete samples)
- RI/FS Report

RI/FS Objectives

- Level 2 Imminent and Substantial Endangerment Response
- Determine nature and extent of MEC and MC for entire 187-acre site
- Explosives safety hazard assessment
- Human health/ecological risk assessment
- Propose and evaluate remedial alternatives

MEC Issues/Objectives

- Development of ESS before Work Plan
  - Restricts changes to Work Plan after ESS Submittal
  - Uncertain lead time for ESS Review
- Vegetation Clearance
  - Complete detector access to entire acreage
  - Use of gas-powered weed whackers and chain saws
- Blow in Place vs. Move MEC
  - UXO Personnel must determine “acceptable to move”
  - When in doubt, BIP

MEC Issues/Objectives (cont'd)

- Minimum Separation Distances for public – 3.5-inch Rocket
  - Unintentional detonations – 235 feet
  - Intentional detonations – 457 feet
- Team Separation Distance – 56 feet
- Engineering controls
  - Not needed except possibly to protect archaeological features
  - Sandbags – difficulty getting to site
  - Cover with surrounding soil – potential for erosion
- Munitions Debris removal
  - Military support to remove by air?
  - Transport down mountain to collection point

MEC Issues/Objectives (Cont'd)

- MD Temporary Storage
  - Conex on site
  - Conex at Marine Corps Base Hawaii
- MD Disposal
  - Ship to Continental United States for destruction
- Archaeological Monitors
  - Essential Team Members
  - Periodic Monitoring

MC Issues/Objectives

- Number of samples (35 discrete proposed)
- Type of samples – discrete vs. composite
- Sampling Locations
  - Target areas only?
  - Four SI locations identified in SI?
  - MEC locations?
- Sample analytes based on SI recommendations
  - Copper
  - Lead

RI/FS Report

- Risk Assessments
- Develop alternative remedies
- Screen alternatives for effectiveness, implementability, and cost
- Analyze & compare alternatives

EE/CA Alternative

- Complete RI Fieldwork
- EE/CA Approval Memorandum
- Develop EE/CA Report
- Public Review
- EE/CA Action Memorandum
- Removal Action
- Transition back to RI/FS

Transition Back to RI/FS

- Complete RI/FS Report
- Publish Proposed Plan
- Decision Document
- Implement Remedial Action
- Response Complete
- 5-Year Review

RI/FS Schedule

• RI Planning Documents	Present - Aug 2009
• RI Fieldwork	Sep 2009 – Dec 2009
• RI/FS Report	Dec 2009 – Jun 2010
• Proposed Plan	Jun 2010 – Aug 2010
• Decision Document	Aug 2010 – Sep 2010
• Remedial Design	Oct 2010 – Jan 2011
• Remedial Action	Feb 2011 - ???

Alternative Schedule

• RI Planning Documents	Present - Aug 2009
• RI Fieldwork	Sep 2009 – Dec 2009
• EE/CA Approval Memo	Dec 2009 – Jan 2010
• EE/CA Report	Dec 2009 – May 2010
• Action Memorandum	Apr 2010 – May 2010
• Removal Design	Jun 2010 – Sep 2010
• Removal Action	Sep 2010 - ???
• Transition to RI/FS	Completion of RA

Questions?

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Problem Statement

- Portions of Waikane Valley Training Area contain MEC which pose an imminent and substantial danger to any person wandering through the site.
- There is a potential for localized lead and copper contamination due to degradation of MEC.
- Conduct an RI/FS to address 187-acre site, consisting of surface clearance in target areas to reduce imminent and substantial danger, subsurface sampling (2 acres) in target areas to determine the nature and extent of residual MEC, and additional MC samples to verify extent of lead/copper contamination.

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Attachment F
NAVFAC Pacific Standard Operating Procedures
(on CD-ROM at end of document)

Attachment G
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APPENDIX D. QUALITY CONTROL PLAN

This appendix contains the Quality Control Plan required for this effort.

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1.0 GENERAL QUALITY CONTROL PROCEDURES

This section outlines the general quality control inspection, documentation, and testing activities required to ensure that all work performed complies with the specified scope, schedule, budget, and level of quality anticipated by the Navy as well as the requirements of PWS, the WP and the MEC and MC QAPPs. The QAPPs outline the procedures the Quality Control (QC) personnel will use to conduct the audits and inspections of the DFWs for the RI/FS.

USAE's QC process starts with top management commitment and involvement. The process provides a permanent and workable system that allows each employee to understand his/her specific job performance requirements. The QC and Improvement Processes ensure that the actions, procedures, and tools support every employee and provide training necessary to perform a job according to the requirements.

Checklists (three phases of control discussed in Section 1.10) have been developed to ensure that the DFWs are addressed and that the QC audits are documented. The overall objective of the QC process is to ensure that work is performed consistently with the PWS, reduce specific cause variations, and continually improve all processes associated with the contract.

1.1 QUALITY MANAGEMENT KEY PERSONNEL

The following paragraphs describe the organizational structure of USAE's Quality Management Team during operations at the project site. Names and qualifications of site personnel will be provided prior to mobilization.

1.1.1 CORPORATE QUALITY CONTROL MANAGER

The Corporate QC Manager has overall responsibility for the QC program. The Corporate QC Manager reports directly to the President on matters of effectiveness, adequacy, and status of QC methods and procedures. The Corporate QC Manager has the following responsibilities:

- Prepare QC policies and procedures
- Ensure timely submission of contract deliverables
- Provide overall management of the Quality Program.

1.1.2 PROJECT MANAGER

The Project Manager (PM) is responsible for the overall performance during this project. The PM will develop and implement the site WP and also has the following responsibilities:

- Serve as primary point of contract with the RPM
- Monitor project performance, safety, quality, cost, and schedule
- Ensure timely submission of contract deliverables
- Report directly to the Program Manager

1.1.3 SENIOR CORPORATE GEOPHYSICIST

The Senior Corporate Geophysicist will perform the duties of the Project Geophysicist. He is responsible for ensuring the completeness and accuracy of the DGM. He coordinates with the Site Geophysicist for daily operations and maintains a direct line of communication to the MRC

Program QC Manager and PM. The Project Geophysicist reports directly to the Program Manager and has the following responsibilities:

- Develop and enforce the DGM procedures
- Coordinate with the Program QC Manager (PQCM) to ensure DGM procedures are appropriate in demonstrating validity sufficient to meet QC objectives
- Monitor and review site DGM data
- Record and report the results to the appropriate personnel
- Recommend to the PM any actions to be taken in the event of a DGM QC failure.

1.1.4 PROGRAM QUALITY CONTROL MANAGER (PQCM)

The PQCM is responsible for ensuring that QC methodologies are incorporated into all projects conducted under the aegis of the Munitions Response Contract to include this RI/FS at WVIA. The PQCM holds current certification as a Certified Manager of Quality/Organizational Excellence (CQM/OE) and Certified Quality Auditor (CQA). He additionally has the following responsibilities:

- Overseeing the specific quality control procedures relevant to this contract
- Maintaining a Continuous Improvement Program that incorporates documented lessons learned
- Conducting Root Cause Analysis when necessary
- Reviewing employee qualification records to ensure accuracy
- Evaluating periodic field audits of sites, programs, and projects to ensure QC compliance.
- Providing oversight of QC procedures onsite and direction to the UXOQCS
- Ensuring the RI/FS Report is accurate and complete

1.1.5 UXO QUALITY CONTROL SPECIALIST (UXOQCS)

The UXOQCS is responsible for overseeing the site QC plan in all field operations. The UXOQCS will be trained in QC techniques methodology and be qualified as a UXO Technician III. The UXOQCS coordinates with the PM for daily operations and maintains a direct line of communication to the PM and SM. The UXOQCS reports directly to the PQCM and has the following responsibilities:

- Reviewing, implementing, and enforcing the QC plan
- Coordinating with the Navy QA representative to ensure DQOs are appropriate for the task being performed
- Coordinating with the PQCM to ensure QC procedures are appropriate in demonstrating validity sufficient to meet QC objectives
- Performing periodic audits of USAE's performance under the contract.
- Assisting the PQCM in Root Cause Analysis
- Recommending to the PM any actions to be taken in the event of a QC failure
- Maintaining a Lessons Learned log
- Placement and control of Coverage Seeds for QC purposes
- Has STOP WORK authority for issues regarding QC at the project site.
- Conducting QC inspections of documents, work in progress, work performed, and monitoring. Recording and reporting the results to the appropriate personnel
- Overseeing DGM operations in regards to Quality considerations

- Ensuring classification of MEC-related items
- Recommending to the PQCM any actions to be taken in the event of a QC failure
- Advising the SUXOS and MEC Team on all QC-related site matters
- Reporting non-compliance with QC criteria to the project personnel and the UXOQCS

1.2 CONTRACT SUBMITTAL QUALITY CONTROL PROCESS

Documents required under this contract will be developed and maintained by a project team consisting of the PM, Project Engineer, Project Geophysicist, GIS Manager, and the PQCM. These team members will contribute their corporate knowledge and experience to the documents to ensure technical quality.

- The PM will take the lead in development of contract documents, and will schedule a peer review and a QC review in sufficient time to meet project milestones for delivery of submittals.
- The Project Engineer will provide technical writing support to develop the documents, and will review completed documents to ensure accuracy and completeness.
- The Project Geophysicist will ensure a technically sound approach to fieldwork, accuracy, and completeness of reporting on geophysical data.
- The GIS Manager will develop a digital database and maps, overlays of grid patterns and EZs, and other spatial data. The GIS Manager will prepare all drawings or maps needed for submittals, and will perform QC of civil survey data.
- The PQCM will review all documents prior to submittal.
- After the project team has performed a peer review of documents, the PQCM will perform a QC review to ensure overall quality and completeness.

Comments on submitted documents will be directed by the PM to the appropriate subject matter experts for resolution. The PM will provide a written response for each comment. In addition, the PM will provide a copy of the comments and responses to the PQCM and, if necessary, the Corporate Quality Manager for an assessment of the need for corrective action or lessons learned.

Changes to final WPs will be submitted to the PQCM and/or UXOQCS immediately upon approval. The PQCM and/or UXOQCS will be responsible for ensuring that the changes are incorporated into the hard copy documents on file and that all field personnel are made aware of the changes.

1.3 MEETINGS

1.3.1 DAILY QUALITY CONTROL MEETING

After the start of site work, the UXOQCS will conduct daily QC meetings with the Site Manager responsible for the upcoming work and with supervisory personnel (SUXOS, Team Leaders, etc.). Meetings conducted will be recorded in the Weekly QC Report. The RPM or designated representative may attend any of these meetings. These meetings may be held in conjunction with the Daily Production Meeting. As a minimum, the following will be accomplished at each meeting:

- Review the schedule.
- Review the status of submittals.
- Schedule the three phases of control and testing.
    - Preparatory Phase.

  - Initial Phase.
  - Follow-up Phase.
- Resolve QC and production problems.
- Evaluate field recommendations for inclusion in the Lessons Learned post-project report.
- Address items that may require revising the Project QC Plan.

1.3.2 WEEKLY ON-SITE QUALITY CONTROL MEETING

Following mobilization, the UXOQCS will conduct weekly QC meetings with the Site Manager (SM), SUXOS, any subcontractor representatives, and other necessary personnel. The meetings will be noted in the Weekly Status Report. Meeting minutes will be prepared and submitted to the PM within three business days of the meeting. An agenda format that will be developed with concurrence between the UXOQCS and the PM will be used to conduct the meetings. At a minimum, topics of discussion will include:

- Weekly progress.
- Upcoming work.
- Schedule.
- Status of submittals
  - Submittals reviewed and approved since last meeting.
  - Submittals required in the near future.
- Significant QC/QA problems and corrective actions taken.
  - ➢ Identify any outstanding Corrective Action Request (CAR) with suspense dates
  - ➢ Identify any outstanding Deficiency Notice (DN) and response requirements
- Review the work to be accomplished during the next week and documentation required.
  - Establish completion dates for rework items.
  - Identify Preparatory phases required.
  - Identify Initial phases required.
  - Identify Follow-up phases required.

1.4 FIELD 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. In addition to the implementation of the three phases of control process, inspections will be performed at random, with unscheduled checks of the site to ensure personnel accomplish all work as specified in the WP. The UXOQCS will utilize the process outlined in Figure 1-1 (Quality Control Process), to ensure all field tasks meet quality standards prior to submittal for the Quality Assurance process. The UXOQCS will submit a report to the PQCM detailing the results of these checks. Any audits will be performed by the UXOQCS.

The UXOQCS will prepare a weekly QC Report and submit it to the PM for distribution to the appropriate personnel. The QC Report will include:

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

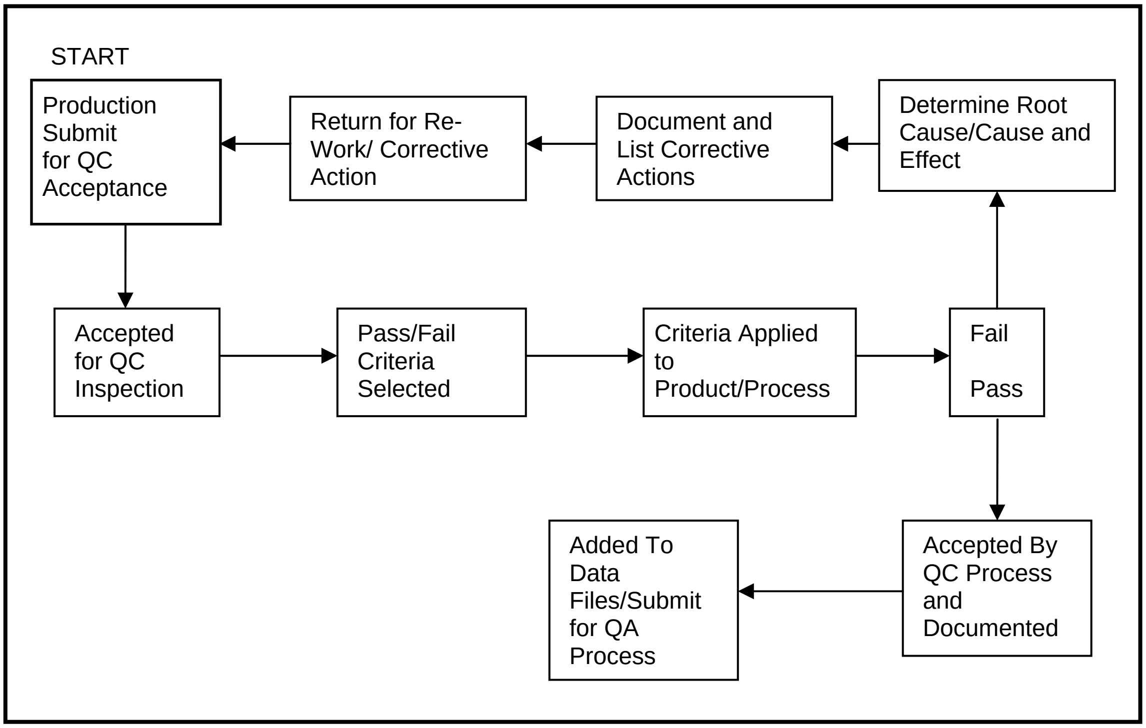

Figure 1-1: Quality Control Process

1.5 LOGS AND RECORDS

Activity Logs will be maintained daily, as applicable, and all entries will be made in ink. Logbooks will be bound and pages consecutively numbered. Logbooks and records may be supplemented by the use of preprinted forms (e.g., safety inspection forms, tailgate safety briefings). These forms help to ensure uniformity of activities being conducted, inspected, and reviewed. Examples of QC forms are included in Appendix F of the WP. The following logbooks and records will be maintained on site and are subject to inspection.

1.5.1 DAILY OPERATIONS SUMMARY

The Daily Operations Summary, maintained by the SM, 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
- Field Change Request to the WP, SHSP, policies, or procedures
- Injuries and /or illnesses
- Safety briefings
- MC and MEC/MPPEH encountered
- Relevant events and training

- 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 the SM.

1.5.2 FIELD LOGBOOKS

The Field Logbooks are maintained each field day by the SUXOS, Team Leaders, and the Site Geophysicist. These logbooks are used to record site activities and field data. Logbooks are maintained in a neat and legible manner and provide a historical record of site activities, to include:

- Date and team location
- Personnel and work performed
- Equipment and instrument checks
- Injuries and/or illnesses
- Verification that each anomaly dig site was inspected prior to backfilling
- Changes to work instructions
- Work stoppage
- Visitors
- Other relevant events
- Signatures of the SUXOS, Site Geophysicist, and Team Leaders.

1.5.3 QUALITY CONTROL LOGBOOK

The Quality Control Logbook will be maintained by the UXOQCS. This logbook is used 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
- Recommendations or observations that may be included as Lessons Learned
- Signature of UXOQCS.

1.5.4 TRAINING RECORDS

Training records will be maintained by the SM. These records contain any licenses, certificates, or other qualifying data, to include:

- Date and nature of training.
- Personnel attending and instructor(s)
- Visitor training and briefings
- Signature of the instructor and SM.

1.5.5 MEC, MPPEH AND ANOMALY RECORDS

The MEC, MPPEH and anomaly records are individually prepared records (see MEC-MPPEH Log in Appendix F). These records are prepared by the SM and are used to record data on anomalies and MEC, MPPEH encountered. The Technical Manual (TM) 43-Series will be used as the nomenclature protocol for recording items in the Log.

1.5.6 PHOTOGRAPHIC LOGBOOK

The Photographic Logbook will be maintained by the SM. This logbook is used to record all photographs taken on the project site. These photographs are used to document MEC and MPPEH encountered, as well as site conditions before, during, and after operations. Photographs will include the following information:

- Date and time taken
- Unique identifying number(s) relating to the Photographic Logbook
- Location photograph was taken from and direction looking
- GPS location of all MC, MEC, MPPEH encountered
- Brief description of the subject matter.

1.5.7 FIELD CHANGE REQUEST (FCR) AND FCR LOG

Throughout the project, the SM will maintain the FCR Log used to track all FCRs throughout the approval process for significant deviations from this WP or its sub-plans requiring approval from the Navy. See Section 1.8 for details of the FCR process.

1.5.8 DAILY REVIEW OF FIELD DATA

During daily field activities the UXOQCS will review portions of the field data, on a daily basis, to ensure accurate classification and documentation of recovered MC, MEC, and MPPEH-related items. This review will be conducted in accordance with the three-phases of control process in Table 32-1 attached to WS #32 of the QAPP for each AOC.

1.6 EQUIPMENT TESTS, FUNCTIONAL CHECKS, CALIBRATION, AND MAINTENANCE

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. 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 satellite 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.

1.6.1 DIFFERENTIAL REAL-TIME KINEMATIC GLOBAL POSITIONING SYSTEM TESTS

The RTK GPS will be tested above a control monument with known coordinates each workday prior to beginning field activities. A variance of 7.62 cm (0.25 ft) is acceptable. If deviations are greater, the GPS planning software results will be re-examined using a current satellite ephemeris file and a project-specific coordinate.

1.6.2 GEOPHYSICAL EQUIPMENT

The following geophysical instruments will be used on this project. The QC staff will use the audit procedures listed in Table 32-1 of the MEC QAPP to verify that the operating procedures outlined in the SOPs are followed throughout the conduct of this project.

1.6.2.1 EM61-MK 2

The EM61-MK2, an enhanced version of the patented EM61, is a time domain metal detector that detects both ferrous and non-ferrous objects with excellent spatial resolution. Target response is a single, sharply defined peak, facilitating quick and accurate location. The QC staff will verify that the operating procedures outlined in the SOP 2 are followed throughout the conduct of this project.

1.6.2.2 Schonstedt GA-52Cx

The handheld Schonstedt GA-52Cx, magnetometer will be tested against the known site anomalies at the established ITS each workday prior to field activities. The known anomalies within the ITS will be seed items that meet the size and depth requirements necessary to determine the serviceability of the instrument.

1.6.3 GEOPHYSICAL INSTRUMENT PERFORMANCE

The UXOQCS will track the performance of each instrument used on site. Daily records provided by the Site Geophysicist will be monitored and aggregated into the RI Report that details instrument performance during ITS Certification and field operations throughout the project.

1.6.4 MAINTENANCE

The UXOQCS will audit field logbooks on a weekly basis to ensure that maintenance of vehicles and equipment is performed on a regular schedule and in accordance with the manufacturer’s recommendation or owner’s manual for equipment requiring regular upkeep.

The UXOQCS will coordinate scheduled maintenance of the following equipment in accordance with the manufacturer’s recommendations or the owner’s manual.

- Vehicles
- PPE

- Communications Equipment
- Geophysical, Navigational and PDAs
- Setup and grounding of the Type II Magazine
- EM61-MK2 detectors
- Handheld Magnetometers and all-metals locators
- Emergency Equipment.

Replacement equipment will meet the same specifications for accuracy and sensitivity as the equipment removed from service. Geophysical instruments will be checked on the test strip daily and after any repairs. They will be required to demonstrate a consistent detection rate for all seed items and any identified background anomalies. Repair or replacement of parts will meet the manufacturer's specifications and recommendations. The UXOQCS will document and maintain records pertaining to the testing, repair, and/or replacement of instruments and equipment on site. Spare instruments of each type will also be mobilized to the site.

1.6.5 ACCURACY

Control monument locations, boundaries of areas scheduled for clearance, and boundaries of cleared areas will be verified and certified by the UXOQCS. The UXOQCS will additionally perform daily reviews of the MC/MEC data to ensure accurate categorization of munitions-related items encountered and to ensure that all MC/MEC items are accounted for.

GIS coverage will be evaluated by the UXOQCS to determine if the geographic features are correct. Errors found will be corrected and noted in the operations field logbook. The accuracy of grid corners will be to the closest 30 cm (11.8 ft). 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 (e.g., corners or intersections).

1.7 INSPECTION PROCESS

The UXOQCS will be responsible for verifying compliance with this section of the plan through the implementation of the three-phase control process described in this section and the MEC QAPP. This process will ensure that all project activities comply with the approved plans and procedures.

The UXOQCS will ensure that the three-phase control process is implemented for each of the DFWs listed in QAPP WS #14 and #32. Each control phase is important for obtaining a quality product. Production work will not be performed on a DFW until the preparatory and initial phase inspections have been successfully completed.

1.7.1 THREE PHASES OF CONTROL

Each element of the RI/FS will be identified as a discrete definable feature of work (DFW) and controlled by three distinct phases: Preparatory, Initial, and Follow-up

1.7.2 DEFINABLE FEATURES OF WORK

A DFW is a task that is separate and distinct from other tasks and has separate control requirements. The DFWs that relate to this project are listed in the MEC QAPPs, WSs #14 and #32.

1.7.2.1 Preparatory Phase Checklist

A preparatory phase inspection will be performed prior to the beginning of each Definable Feature of Work (DFW). The purpose of this inspection will be to review the work scope and applicable specifications and verify that the necessary resources, conditions, and controls are in place and compliant before the start of work activities. This inspection will be conducted using the Preparatory Inspection Checklist.

1.7.2.2 Initial Phase Checklist

An initial phase inspection will be performed for each DFW once a representative sample of the work has been completed. The purpose of the inspection will be to check the preliminary work for compliance with procedures and contract specifications, verify inspection and testing, establish the acceptable level of workmanship, review the minutes of the preparatory phase, and check for omissions and resolve differences of interpretation. This inspection will be conducted using the Initial Phase Inspection Checklist.

1.7.2.3 Follow-up Phase Checklist

A follow-up phase inspection is performed each day that work on a DFW is performed. The purpose of the inspection is to ensure continuous compliance and level of workmanship. The UXOQCS will observe the same activities as under the initial inspection and ensure that discrepancies between site practices and approved specifications are identified and resolved. Corrective actions for unsatisfactory conditions or practices will be verified by the UXOQCS prior to continuing work on the affected feature.

1.8 FIELD CHANGE REQUEST

Changes to plans or procedures will be documented using an FCR form (see Appendix F). An FCR is used to request and document changes identified as a result of unanticipated field conditions or errors in the WP documents. See Figure 1-2 for issues to consider when submitting a request for change to approved documents or procedures. The FCR forms are signed by the RPM to acknowledge the changed condition.

Field personnel are responsible for forwarding any request for change/revision to an existing document to the UXOQCS. Under no circumstance (with the sole exception of immediate safety concerns) should a change/revision be incorporated until it has been reviewed and approved by the RPM and the appropriate Contracting Officer or his/her representative as needed.

The UXOQCS is responsible for determining the validity of the change/revision recommendation and, if deemed valid, forwarding the recommendation expeditiously within the project management chain to those personnel responsible for review and approvals.

The PM is responsible for ensuring that procedures specified by the PWS, WP, and accepted SOPs and supporting documents are strictly adhered to throughout the project. However, projects are always dynamic processes and thus changes and/or revisions can and will be identified throughout its duration. It is the responsibility of the PM to ensure that any change/revision to an already agreed upon procedure is processed and authorized prior to implementation.

The PQCM is responsible for the continuous improvement of all processes within his/her program to include the management of specific projects. To accomplish this, the PQCM will be responsible for the following:

- Becoming thoroughly familiar with the procedures of all projects under his/her cognizance

- Periodically observing project management on-site (if specifically requested by the Navy RPM)
- Reviewing procedural change recommendations from field crews and/or project managers
- Recommending authorization for specific changes/improvements to field operations to the Program Manager.

The Program Manager will be the final arbiter of the validity for the recommendation within the organizational chain. If deemed valid, the PM will contact the Contracting Officer or his/her representative and request that the change be incorporated into field procedures. Documents will be drafted, reviewed, finalized, and approved for use by the appropriate sections, to include Safety, QC, and Operations.

Personnel identifying a need for change or revision to an existing document will complete an FCR Form and submit it to the management chain for processing. The following guidance is designed to assist in properly addressing the change/revision being sought.

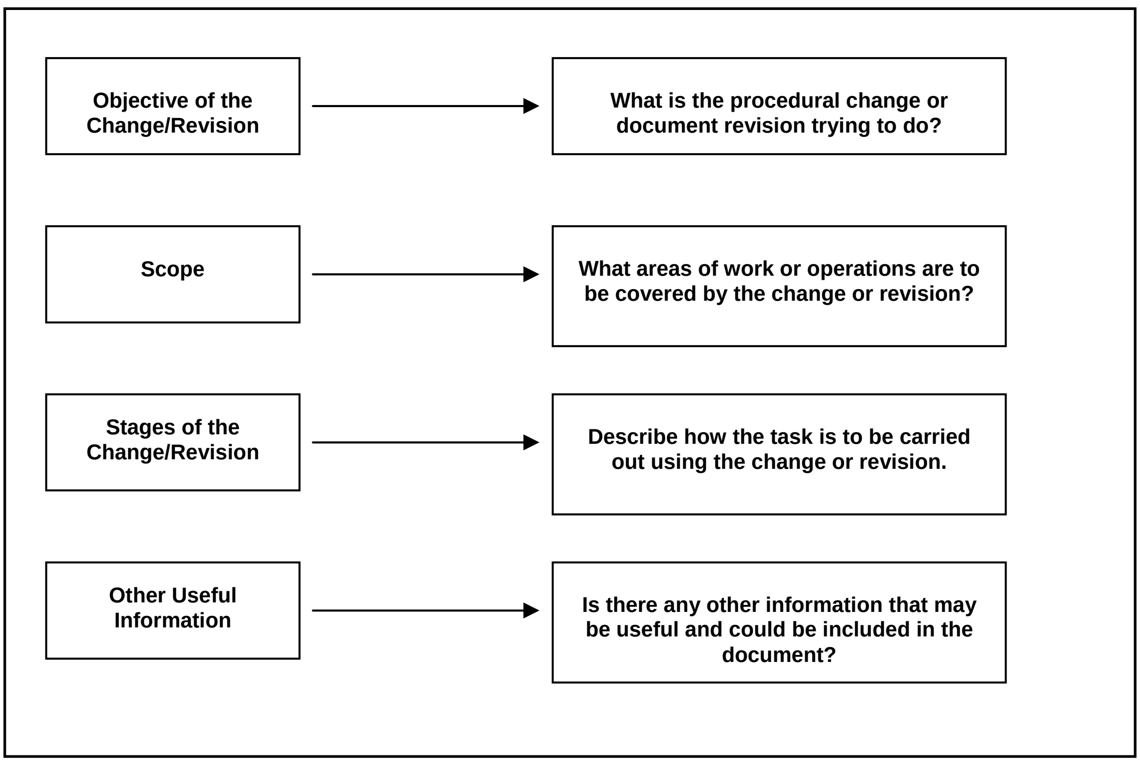

Figure 1-2: Considerations When Submitting a Request for Change

A request for a change or revision to an existing document must be accompanied by a draft of the change or revision being sought. This draft must include the original text, the proposed text, references for the proposed change or revision (e.g., regulatory update, contract change, variation of equipment) to include page, paragraph, bullet, drawing, figure, section, or subsection of the reference material.

A request for a change or revisions to an existing document will follow a review and approval process that incorporates the various sections or departments as needed to determine the validity of the request and ensure that authorized, appropriate personnel have agreed to and signed the approval form for a change or revision to be completed. Personnel assigned to review the request will determine answers to the following questions.

- Has the request been submitted for an existing document?
- Does the request document the change or revision needed?
- Has a draft, with reference material, been submitted?
- Have the various sections or departments affected by the request been notified?

Once the request has been entered into the review and approval process, personnel assigned to process the request will determine answers to the following questions?

- Is the change or revision required by a regulatory or contractual document?
- Is the change or revision necessary due to variations in equipment, training, or personnel?
- Will the change or revision affect other document(s) and have they been identified?
- Will the change or revision impact safety, quality, or production in a positive or negative manner?
- Does the proposed change or revision meet the needs of the requirement?

Once a change or revision has been accepted and implemented, outdated or obsolete documents will be removed from use and the change or revision disseminated and briefed to affected personnel, sections, or departments. Those changes or revisions that affect other documents will be briefed as well to ensure continuity between the various documents.

If training is required by a change or revision, site management will address it and have the necessary training scheduled, as appropriate.

1.8.1 DEFICIENCY MANAGEMENT

All deficiencies or nonconforming conditions discovered during inspections or other QC functions will be noted on a DN. The DN will identify, at a minimum, any corrective action required, the individuals reviewing and approving the actions, and the actions taken to prevent recurrence. A Deficiency Notice log will be maintained to document and track corrective actions to closure and be included in the RI/FS Final Report. The UXOQCS will be responsible for tracking deficiencies to closure and reporting their status on daily reports and log forms. .

1.8.2 CORRECTIVE ACTION

Once a process displays a characteristic out of specification with those required for the project or quality objectives, corrective action must be conducted to identify the cause of the deficiency or nonconformance. When the cause of the problem is identified, appropriate corrective action can be instituted and then monitored for effectiveness.

1.9 ROOT CAUSE ANALYSIS

The UXOQCS will conduct a Root Cause Analysis to determine if the failure is the result of the process, procedures, equipment, and/or personnel. The UXOQCS will provide his findings to the SM, PQCM, and PM with suggested corrective actions. Once the corrective actions are approved by management, the field teams will implement them. The Root Cause Analysis and corrective actions will be attached to the weekly report.

1.9.1 IMPLEMENTATION OF CORRECTIVE ACTION

Following the root cause analysis, the project personnel will undertake the most effective remedy to correct the problem. Potential remedies to be considered may include the following:

- Supplemental training of personnel
- Changes of equipment or modification of equipment currently in use
- Acquisition of supplemental equipment
- Implementation of new procedures or modification of existing procedures
- Changes in QC procedures.

Successful implementation of corrective action will be documented on the DN. Through follow-up phase surveillance, the UXOQCS will verify that the corrective action implemented has rectified the deficient condition and is sufficient to prevent recurrence.

Figure 1-3 illustrates the flow of the root cause and effect process the PQCM, PM, and UXOQCS will use to determine failure causes.

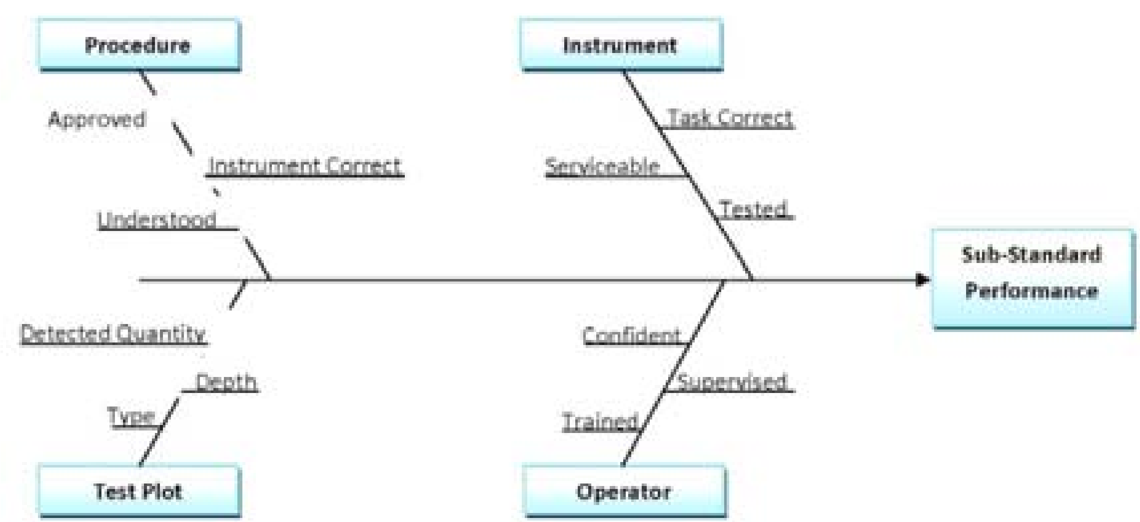

Figure 1-3: Cause and Effect Process

1.10 SPECIFIC QUALITY CONTROL PROCEDURES

USAE will employ the specific quality control procedures, audits, and inspections detailed in the MEC QAPP WS #14 and Table 32-1 to ensure the quality standards required to achieve the DQOs. The UXOQCS will be responsible for verifying compliance through the implementation of the three-phase control process described in Table 32-1. This process will ensure that all project activities comply with the approved plans and procedures. The project QC process culminates in the Verification and Validation processes outlined in the MEC QAPP WS #35 and #36, and the Usability Assessment per WS #37.

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2.0 CONTINUOUS IMPROVEMENT PROGRAM

A Continuous Improvement Program will be maintained on-site. It will include the following actions.

- The UXOQCS will solicit, on a weekly basis, lessons learned from on-site personnel.
- The SM, UXOQCS, and SUXOS will review lessons learned for appropriateness.
- Recommendations for improvements to the work process will be forwarded to the PQCM, who will review and forward to the Program Manager.
- Upon review and approval by the Program Manager, recommendations for improvement will be forwarded to the Contracting Officer's Representative for consideration

2.1 LESSONS LEARNED

The objective of capturing lessons learned is to share experiences or recognized potential problems, and then identify best practices to:

- Prevent the recurrence of repetitive design/execution deficiency
- Clarify interpretation of regulations or standards
- Reduce the potential for mistakes in high risk/probability areas of concern
- Pass on information specific to an installation or project
- Promote a good work practice that should be ingrained for repeat application
- Promote efficient and cost-effective business practices.

The project team will be responsible for identifying and submitting lessons learned for review and approval. Throughout this RI/FS, the project team members will consider how their experiences might be appropriate for the Lessons Learned Program (LLP).

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APPENDIX E. SITE-WIDE ACCIDENT PREVENTION PLAN/SITE HEALTH AND SAFETY PLAN

This appendix contains the Site-Wide Accident Prevention Plan/Site Health and Safety Plan for the Waikane Valley Impact Area.

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APPENDIX E: SITE-WIDE ACCIDENT PREVENTION PLAN/ SITE HEALTH AND SAFETY PLAN

ACKNOWLEDGEMENT SHEET

Accident Prevention Plan/Site Health and Safety Plan Acknowledgement

I have read, understand, and agree to abide by the provisions as detailed in this Accident Prevention Plan and Site Health and Safety Plan prepared by USA Environmental, Inc. Failure to comply with these provisions may lead to disciplinary action and/or my dismissal from the work site.

Printed Name	Company	Signature	Date

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ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
CFR	Code of Federal Regulations
°F	Degrees Fahrenheit
DoD	Department of Defense
EM	Engineer Manual
EOD	Explosive Ordnance Disposal
EZ	Exclusion Zone
GPO	Geophysical Prove-Out
MEC	Munitions and Explosives of Concern
MGFD	Munition with the Greatest Fragmentation Distance
MSDS	Material Safety Data Sheet
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PPE	Personal Protective Equipment
SOW	Statement of Work
SUXOS	Senior Unexploded Ordnance Supervisor
USAE	USA Environmental, Incorporated
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer

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1.0 SIGNATURE SHEET

Plan approval:

Jonathan Chionchio ______________________ Date: Feb 10, 2010

Jonathan Chionchio
President
USA Environmental, Inc.
(813) 343-6350

Plan concurrence:

Cheryl M. Riordan ______________________ Date: Feb 10, 2010

Cheryl M. Riordan
Certified Safety Professional
USA Environmental, Inc.
(813) 343-6412

Plan prepared by:

James Walden ______________________ Date: Feb 9, 2010

James Walden
UXO Safety Manager
USA Environmental, Inc.
(813) 343-6374

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2.0 BACKGROUND INFORMATION

This Accident Prevention Plan (APP) has been prepared by USA Environmental Inc. (USAE) for the Remedial Investigation/Feasibility Study (RI/FS) of the Waikane Valley Training Area, Kaneohe, Hawaii.

2.1 PURPOSE

The purpose of this APP 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 APP assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are being conducted during the Remedial Investigation process. The APP will interface with the USAE Corporate Safety and Health Program.

2.2 PROJECT DETAILS

Contractor
USA Environmental, Inc.
720 Brooker Creek Boulevard, Suite 204
Oldsmar, FL 34677

Contract Number
N62742-05-D-1868

Task Order Number
CTO: 0010

Project Name
Remedial Investigation/Feasibility Study of Waikane Valley Training Area, Kaneohe, Hawaii

2.3 PROJECT DESCRIPTION

See Section 1.1 "Site Description" of the Site Health and Safety Plan (SHSP) and Table 2-1.

Table 2-1: Site Description

Site Location	Approximate Size (Acres)
Waikane Valley Training Area, Kaneohe	187 acre site. RI approximately 102 acres.
Topography	**Present Usage**
X Forested ☐ Tillage ☒ River/Creeks Grassland Flat land Open Terrain ☒ Wetland ☐ Arid X Other: Ridges, valleys, and volcanic craters. Rain forest and steep terrain	☐ Rural ☐ Commercial ☐ Urban ☐ Government ☐ Industrial ☐ Farming ☐ Ranching ☐ Residential ☐ Recreational ☒ Military ☐ Other

2.4 DESCRIPTION OF WORK

Work on this project involves a Remedial Investigation/Feasibility Study of the Waikane Valley Training Area on the Marine Corps Base Hawaii on Kaneohe Bay, located on the windward side of Oahu. The Marine Base Hawaii includes approximately 3,000 acres of land with four volcanic craters, with elevations ranging from 0 – 850 feet msl. The area includes heavy vegetation and rain forest with steep terrain. The total site is 187 acres, with approximately 102 acres for the Remedial Investigation of the area in order to make an appropriate characterization of the MEC contamination, and make recommendations on remediation alternatives based on proposed future land use. There will be vegetation removal in the 4 AOCs, as well as a 100% surface clearance. There will be investigation to a 2-foot depth of selected grids in AOCs 1 and 4, and a subsurface investigation of several grids to a 4-foot depth of AOCs 2 and 3. A report will be issued based on the findings of the Remedial Investigation for each of the ranges involved. Soil samples will also be taken in order to determine extent of munitions constituent (MC) contamination.

2.5 CONTRACTOR ACCIDENT EXPERIENCE

USAE's Experience Modification Rate for the last five years is shown in Table 2-2. A copy of the latest Occupational Safety and Health Administration (OSHA) Form 300 is provided in Attachment 1.

Table 2-2: Experience Modification Rate

Report Period	Interstate	Intrastate
2009	0.72	N/A
2008	0.70	N/A
2007	0.80	N/A
2006	0.78	N/A
2005	0.69	N/A

2.6 PHASES OF WORK REQUIRING ACTIVITY HAZARD ANALYSIS

The following phases of work on this project require an Activity Hazard Analysis (AHA):

- Geophysical Prove Out Test Strip
- Location Surveying and Mapping
- Surface Clearance
- MEC Investigation
- MEC Disposal Operations
- Inspection/Certification of Munitions Debris
- Quality Control
- Vegetation Removal
- Soil Sampling.

The AHA forms are located in Attachment 2 of this APP.

Table 2-3: Hazards Table

Hazards*	Action Levels**
Safety: include falling (rocks, inclines, slippery surfaces); climbing (uneven terrain); walking (uneven terrain, surface indentations); hand and power tool operations (hammers, machetes chainsaws, weed eaters) eye and face hazards (vegetation removal operations); and MEC.	None/Awareness/Avoidance
Chemical: Lubricants and fuels for equipment.	Per Material Safety Data Sheets
Physical: include heat injuries, and noise.	Per Monitoring Requirements
Radiological: none anticipated.	Not Applicable
Biological Hazards: may be present; include biting and stinging insects, hazardous plants and wildlife.	None/Awareness/Avoidance
MEC: may be present on site, use approved measures.	Observe Safety Procedures

Notes to Hazards Table

***HAZARDS**
Safety:

Falling: (e.g. Open pits; wells; shafts; rocks crevices; steep inclines; slippery surfaces; etc.)

Climbing: (e.g. Falls from structures > 4 feet high; 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)

Eye Hazards: (e.g. Airborne dust/windy conditions; liquid splashes; etc.)

MEC/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. poisonous plants, animals, insects, microorganisms, etc.)

MEC: Evaluate exposure; minimize people, time, and amount of hazardous material. Age or condition of UXO DOES NOT decrease hazard. UXO 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 SHSP 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 that will address the potential exposure. Chemical exposures (releases) requiring evacuation shall always be in an upwind direction to a safe distance. PPE per hazard assessment will be worn.

3.0 STATEMENT OF SAFETY AND HEALTH POLICY

In recognition of the responsibilities of USAE and the need for management to establish a policy with regard to the prevention of on-the-job injuries, this APP has been developed. Through application of these safety policies and procedures, it is USAE's primary goal to reduce to a minimum the human suffering by employees resulting from occupational injuries. Not only can injuries have a serious physical and emotional impact on the employees themselves, but can also have a negative effect on family members and co-workers.

In addition, we must recognize the deterrent and eroding effect injuries have on the potential profit. Insurance costs combined with the indirect costs of injuries are a matter of serious concern and it is USAE's intention that they be reduced. This desired reduction could take place, over a long term, if the frequency of injuries is kept to a minimum. As it affects USAE, the elimination of on-the-job injuries is an important responsibility of management. This responsibility must be assumed and treated in the same manner as our business philosophies relating to services rendered.

For USAE's Corporate Safety and Health Program to become effective, it will be necessary for each employee to take a serious interest in the prevention of injuries. Management fully intends to provide, in administration of the program, the leadership and direction to which supervisory personnel and employees will respond. It is USAE's earnest request that all concerned devote their serious attention toward making this Safety and Health Program an integral part of the day to day business operations. Always remember that no job is so important and no service is so urgent that we cannot take the time to perform our work safely.

All site operations will be performed in accordance with applicable Federal, state, and local regulations and procedures, OSHA requirements, client requirements, and USAE's Corporate Safety and Health Program and this APP. All USAE employees will comply with the requirements of this plan.

4.0 RESPONSIBILITIES AND LINES OF AUTHORITY

All personnel are responsible for continuous adherence to this APP and safety and health procedures during the performance of their work.

4.1 PERSONNEL RESPONSIBILITIES

No person may work in a manner that conflicts with the intent of, or the inherent safety and environmental precautions expressed in these procedures. After due warnings, USAE will dismiss from the site any person who violates safety procedures. USAE employees are subject to progressive discipline and may be terminated for continued violations. All on-site personnel will be trained in accordance with this document.

4.1.1 USAE PROGRAM MANAGER – GEORGE SPENCER

Responsibilities include:

- Ensures conformance with USAE corporate, Navy and USACE policies and procedures
- Coordinates project with the Navy personnel
- Ensures the project has the necessary resources to operate safely
- Ensures that the project personnel satisfy USAE, Navy and USACE Safety & Health requirements.

4.1.2 USAE PROJECT MANAGER – ROBERT NORE

Responsibilities include:

- Coordinates with USAE Program Manager and Navy personnel
- Provides management of all aspects of project work
- Sets the tone for safety on the job site
- Assures personnel have the equipment, training and resources to perform the job safely
- Ensures that the project personnel implement the project APP
- Ensures that the project personnel have the appropriate regard for safe job performance.

4.1.3 USAE PROGRAM SAFETY AND HEALTH MANAGER – ROBERT CROWNOVER

Responsibilities for the Program Safety and Health Manager (PSHM) include:

- Oversight in developing and coordinating the APP as required
- Make changes to the APP if warranted by changed conditions
- General Health and Safety Program administration and enforcement
- Determine the level of personnel protection required
- Investigate significant accidents and illnesses and implement corrective action plans
- Establish air-monitoring parameters based on expected contaminants
- Establish employee exposure monitoring notification programs
- Develop site specific employee/community emergency response plans based on expected hazards
- Stop any operation that threatens the health or safety of the team or surrounding population
- Upgrade or downgrade levels of protection based on site observations or monitoring results.

4.1.4 USAE PROJECT ENGINEER – DAVID SYNAKORN, P.E.

The Project Engineer provides technical, analytical, and report writing support to ensure the technical quality of deliverables to the Navy.

4.1.5 USAE PROGRAM OCCUPATIONAL SAFETY MANAGER – CHERYL RIORDAN, CSP

Responsibilities for the Program Occupational Safety Manager (POSM) include:

- Develop and coordinate the APP as required
- Recommend changes to the APP if warranted by changed conditions
- General Safety and Health Program administration
- Determine the level of personnel protection required
- Confirm each USAE team member's suitability for work based on physician's recommendation
- Conduct field safety and health audits to ensure Safety and Health Plan conformance and USAE policy compliance
- Investigate significant accidents and illnesses and implement corrective action plans
- Certify that all workers have proper training as per 29 CFR 1910.120(e)
- Update equipment or procedures based on information obtained during site operations
- Investigate significant accidents and illnesses and implement corrective action plans

- Establish air-monitoring parameters based on expected contaminants
- Establish employee exposure monitoring notification programs
- Develop site specific employee/community emergency response plans based on expected hazards
- Stop any operation that threatens the health or safety of the team or surrounding population
- Upgrade or downgrade levels of protection based on site observations or monitoring results.

4.1.6 SITE MANAGER – TBD

All site activities will be conducted under the supervision of the USAE Site Manager. The Site Manager will oversee normal and emergency work and will perform any emergency notification. He is also responsible for:

- Supervising all USAE site activities
- Implementing the field APP
- Coordinating with the UXO Safety Officer (UXOSO) on safety-related matters
- Determining evacuation routes
- Presenting daily safety meetings
- Maintaining logs and records in the field
- Implementing changes to APP as directed by the PSHM, POSM, or UXOSO.

4.1.7 UXO SAFETY OFFICER – TBD

Site activities will be conducted under the supervision of the USAE UXOSO for safety on an as-needed basis. The UXOSO will act as safety oversight for normal and emergency work and will perform any emergency notification as the On-Scene-Incident-Commander. He is also responsible for:

- Implementing the field APP
- Enforcing all provisions of the APP
- Establish emergency communications with all potential emergency responders and verifying all emergency telephone numbers prior to the start of site work
- Working with Emergency Medical Technicians (EMTs) and First Responders to ensure injured personnel are decontaminated to the extent possible prior to sending them to a hospital in an ambulance, and if complete decontamination is not possible, for wrapping the patient in a blanket to prevent the spread of contamination and advising the ambulance staff of the hazards
- Determining evacuation routes
- Presenting daily safety meetings
- Presenting training requirements for site personnel and visitors
- Maintaining safety logs and records in the field
- Implementing changes to APP as directed by the PSHM or POSM
- General Health and Safety Program administration and enforcement
- Enforcing the level of personnel protection required
- Investigating work related accidents and illnesses and implementing corrective action plans
- Establishing air-monitoring parameters based on expected contaminants
- Establishing employee exposure monitoring notification programs
- Stopping any operation that threatens the health or safety of the team or surrounding population

- Upgrading levels of protection based on site observations or monitoring results.

4.2 LINES OF AUTHORITY

Table 4-1 lists contact information for project personnel and Figure 4-1 contains the USAE project personnel, their involvement on the project, and the organization these individuals represent.

Table 4-1: Project Contacts

Name	Organization	Telephone	Cell number	E-mail
Richard Hosokawa	Navy Remedial Project Manager	808-472-1423		Richard.hosokawa@navy.mil
Steve Oshiro	Navy Contracting Officer's Technical Representative	808-472-1440		Steve.oshiro@navy.mil
George Spencer	USAE Program Manager	813-343-6358	813-426-2430	gspencer@usatampa.com
Robert Nore	USAE Project Manager	256-830-4249	813-343-6420	rnore@usatampa.com
Robert Crownover	Corporate Safety and Health Manager	813-343-6364	813-748-1642	rcrownover@usatampa.com
Cheryl Riordan	Program Safety and Health Manager	757-486-8567	813-426-2112	criordan@usatampa.com
TBD	Site Manager	813-343-6336		
TBD	UXO Safety Officer	813-343-6336		
TBD	EMT	813-343-6336		

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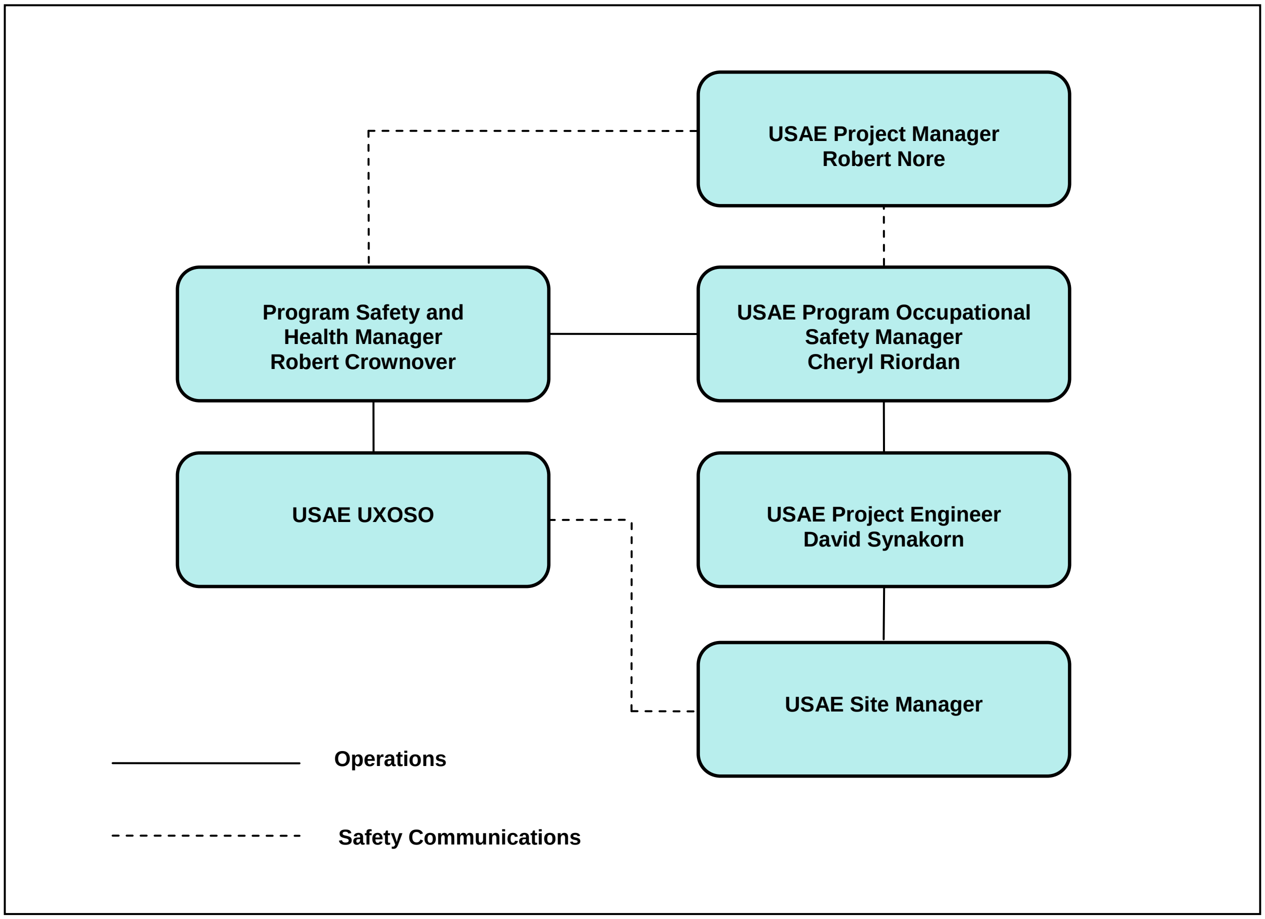

Figure 4-1: Lines of Authority for USAE Corporate and Site Activities

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5.0 SUBCONTRACTORS AND SUPPLIERS

The only USAE subcontractors to be used on this site are CH2MHILL, Wil Chee Planning and Environmental, Inc., and Donaldson Enterprises, Inc.

5.1 MEASURES OF CONTROLLING AND COORDINATING SUBCONTRACTORS

Before work is performed by the subcontractors, USAE will negotiate and prepare an agreement that will detail all necessary and appropriate terms and conditions, including the Scope of Work. Once executed, USAE will perform periodic reviews to ensure that requirements are met. These reviews will cover technical requirements, safety and health requirements, and cost and schedule status. USAE technical staff will review data generated by subcontractors as part of the deliverables.

5.2 SAFETY RESPONSIBILITIES OF SUBCONTRACTORS

All subcontractor personnel will receive training on ordnance recognition and UXO safety precautions prior to commencing activities on the Waikane Valley Training Area project site. All personnel will be given a daily safety briefing and will be escorted by a UXO Technician at all times while on site. All personnel will acknowledge that they have read, understood, and will abide by the Accident Prevention Plan and Site Specific Health and Safety Plan for this project, by signing the acknowledgement page. In addition, personnel must abide by the guidance given by the SUXOS and UXO escort accompanying them at all times. Any deviations from the site plans could be used as the basis for termination of the subcontract agreement. Each subcontractor will also have to submit an AHA for each activity that they will be performing on the site for review and approval prior to starting work on the site.

6.0 TRAINING

Prior to commencement of site activities, the POSM and the UXOSO will ensure that all USAE employees engaged in hazardous waste operations are informed of the nature and degree of exposure to chemical and physical hazards that are likely to result from participation in site operations. USAE will accomplish this by ensuring that all personnel entering the site have received the appropriate OSHA and site-specific training, prior to participation in site activities. OSHA-required training will be conducted prior to site mobilization. Site-specific training will be held at the time of site mobilization and will be reinforced during the daily safety briefings, to which all site workers will be required to attend.

6.1 SUBJECTS TO BE DISCUSSED WITH EMPLOYEES DURING SAFETY INDOCTRINATION

The UXOSO will conduct the three-day OJT. This training will include classroom-type instruction covering the topics specified for site-specific training, and on-site participation in the following:

- Scope of Work
- Details of the Site Specific Health and Safety Plan
- Employee rights and responsibilities
- Sequence of work events
- Identification of safety issues for the site
- Identify Safety staff and lines of authority
- Safe work practices
- Proper lifting techniques
- Recognition of potential MEC and hazards associated with MEC
- Nature and extent of anticipated chemical, physical, and biological hazards

- Measures and procedures for controlling site hazards
- Emergency Response and Contingency Plan
- Location of medical services
- Site communication
- Evacuation routes
- Rules and regulations for vehicle use
- Safe use of field equipment
- Handling, storage, and transportation of hazardous materials
- Use, care, and limitations of PPE
- Hazard communication per OSHA 29 CFR 1910.1200.

6.2 MANDATORY TRAINING AND CERTIFICATIONS THAT ARE APPLICABLE TO THIS PROJECT

6.2.1 GENERAL TRAINING

All USAE employees and subcontractor personnel involved in hazardous waste site activities receive 40 hours of OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) training in accordance with 29 CFR 1910.120 and 29 CFR 1926.65. If it has been more than a year since any worker has received the 40 Hour OSHA HAZWOPER training, he or she must also have a current HAZWOPER 8-Hour Refresher Training in accordance with 29 CFR 1910.120 and 29 CFR 1926.65 prior to working on the site. All workers will also receive three days (24 hours) of site-specific on-the-job training (OJT) under the direct supervision of a trained/experienced supervisor when they mobilize at the site. Any visitor entering the exclusion zone (EZ) during hazardous waste operations will also be required to have current HAZWOPER training. The EZ, during hazardous waste activities would include the project footprint and an area around the footprint of 235 feet, which is the hazardous fragment distance of the 3.5-inch rocket.

All current certifications and training tables for USAE and subcontractor personnel will be maintained on site for the duration of the project. Individuals without proper training records will not be permitted to work on site.

6.2.2 SUPERVISORY TRAINING

On-site managers and supervisors, who are responsible for directing others, will receive the same training as the general site workers for whom they are responsible. They will also receive an additional 8 hours of OSHA-required supervisory training in accordance with 29 CFR 1910.120 and 29 CFR 1926.65 to enhance their ability to provide guidance and make informed decisions. This additional training includes the following:

- Review of the USAE Corporate Safety and Health Program
- Regulatory requirements
- Management of hazardous waste site cleanup operations
- Management of site work zones
- How to communicate with the media and the public
- Personal Protective Equipment (PPE) selection and limitations
- Spill containment
- Monitoring site hazards.

The UXOSO, with specific responsibilities for safety and health guidance on site, will receive the training provided to general site workers and their supervisors. He also will receive advanced training in safety and health issues, policies and techniques. The UXOSO will also receive the 10-hour OSHA Construction Safety class in accordance with Engineer Manual (EM) 385-1-1, 01.A.17.

6.3 REQUIREMENTS FOR EMERGENCY RESPONSE TRAINING

Prior to commencement of the project, all USAE site personnel will review and discuss the posted emergency telephone numbers, location of spill kit materials as applicable, directions to the nearest hospital, the location of all site fire extinguishers, proper use of fire extinguishers, identify the location of first aid kits and blood-borne pathogens kits, and review the emergency procedures. Prior to start of operations a drill will be performed on emergency procedures in order to familiarize personnel. After the drill and after any actual emergency, the site managers will critique the drill or actual emergency response to determine if procedures are working properly or whether changes need to be made to make the procedures more effective.

6.3.1 FIRE PREVENTION

Smoking and lighters are prohibited in the EZ or work zone. A cigarette butt receptacle will be provided in the support zone. No cigarette butts are to be discarded on the ground. No smoking is allowed except in an approved designated location with fire extinguisher. Procedures will be reviewed with all site personnel.

6.3.2 MEC TRAINING

All USAE employees performing work involving the handling and destruction of MEC must be graduates of the U.S. Naval Explosive Ordnance Disposal School (at a minimum Phase I, chemical; and Phase II, surface) or equivalent recognized training. A copy of their certificate of graduation will be kept on file at corporate headquarters. UXO-qualified personnel shall have knowledge and experience in military ordnance, ordnance components, and explosives location, identification, render safe, recovery/removal, transportation, and disposal safety precautions. UXO personnel shall have the knowledge and experience to effect safe handling and transportation of ordnance items found. Copies of certificates of this training will be kept on the project site for the duration of site operations.

6.3.3 HAZARD COMMUNICATION

All USAE employees who will be performing work involving the handling of hazardous materials will receive Hazard Communication training detailing the hazards of the product, appropriate protective measures to prevent exposure to the product, as well as safe procedures for storage and handling of the product, and response to emergencies. Personnel may request a Material Safety Data Sheet (MSDS) for any hazardous material on the site at any time. USAE personnel will be informed that the location of the MSDSs for this site will be in an MSDS binder in the UXOSO site vehicle. This training will occur as part of the initial mobilization training at the site.

6.4 REQUIREMENTS FOR SUPERVISORY AND EMPLOYEE SAFETY MEETINGS

6.4.1 TAILGATE SAFETY BRIEFING

Tailgate Safety Briefings consist of providing short training sessions in various subjects that give the site worker knowledge and confidence in performing duties in a potentially hazardous environment. The Tailgate Safety Briefing will be given prior to commencing work each day and will include such items as:

- Expected weather conditions

- General site hazards
- Biological hazards on site
- MEC hazards
- PPE required at each site
- Emergency evacuation procedures
- AHAs for site operations
- Heat stress precautions
- Buddy system procedures
- A review of any safety violations from the previous day
- Any other significant events involving safety.

Additional briefings will be provided as needed concerning the use of safety equipment, emergency medical procedures, emergency assistance notification procedures, accident prevention, the work plan, and site orientation to ensure that accomplishment of the project can be carried out in a safe and effective manner. All site workers are required to attend the Tailgate Safety Briefing daily.

6.4.2 DAILY DEBRIEFING

At the conclusion of each workday, a debriefing for all employees will be held if appropriate, and the day's work will be discussed to determine if changes are warranted before commencing activities the following day.

6.4.3 PERIODIC SITE TRAINING

On the first workday of each work week/period or more frequently if needed, a pertinent topic will be selected and elaborated upon by the UXOSO during the Tailgate Safety Briefing. These safety meetings will help ensure the safety and health of site personnel in the performance of regular work activities and in emergency situations. Safety meetings will be documented in the appropriate log and the Documentation of Training Form will be completed. Potential topics for discussion are as follows:

- Names and titles of key personnel responsible for site safety and health, and other hazards present at the site
- Components of the Site Safety and Health Program
- General site safety
- Hazards and symptoms of contaminant exposure (chemical) as applicable
- Routes of exposure from on-site contaminants (as applicable)
- Physical hazards (fall protection, noise, heat stress, etc.)
- Biological hazards
- Location and availability of written hazard communication program
- Site and activity PPE (including purpose, donning, doffing and proper use)
- Activity Hazard Analyses for site operations
- Work practices by which employees can minimize risks for hazards
- Safe use of engineering controls and equipment use
- Site control measures
- MEC suspected on-site
- MEC/UXO hazards and precautions

- Reporting requirements for UXO, spills, and emergencies
- Personnel decontamination procedures (as applicable)
- Contingency plans (communications, phone numbers, emergency exits, assembly points, etc.)
- Worker Right to Know/ Hazard Communication
- Emergency equipment locations and use (fire extinguishers, spill kits, first aid kits, etc.)
- Equipment safety.

6.4.4 VISITORS

All visitors to the site, even if escorted, must receive as a minimum, a briefing of on-site conditions, hazards, and emergency response procedures. The UXOSO will generally be the one providing the visitor briefing. All visitors to the EZ will be escorted at all times. When visitors who are not UXO qualified enter the EZ, all MEC operations will cease, and will resume again after the visitor has left the area. Visitors will not be permitted in the restricted work areas unless they have the appropriate level of OSHA training, and are medically approved as part of a company sponsored medical surveillance program. Visitors not complying with the above requirements will not enter the restricted work areas; however, they may observe site conditions from a safe distance in the support zone. All visitors will sign the Visitor's Log prior to entering the site.

6.4.5 TRAINING DOCUMENTATION

A training record will be kept in each employee's individual file to confirm that adequate training for assigned tasks is provided and that training is current. In addition, Documentation of Training Forms will be completed and kept on file at the work site for the duration of site activities, and made available for inspection upon request.

7.0 SAFETY AND HEALTH INSPECTIONS

General safety and health inspections are described throughout this APP. USAE site personnel will conduct safety inspections on a daily basis, or more frequently if conditions warrant. The UXOSO will be responsible for daily safety inspections of the project. During periods when the UXOSO is not present, the Senior UXO Technician who is present will ensure that site personnel follow safety requirements and policy. The Safety Inspection Form will be used to record, track and provide follow up to ensure that safety deficiencies are corrected after they have been identified. A record of the safety inspection checklist will be maintained in the project file. Deficiencies will be identified, posted, and dated when the deficiencies are rectified.

7.1 EXTERNAL INSPECTIONS

External inspections are expected for this project. The Navy Project Manager assigned to the project is responsible for conducting external inspections.

7.2 DAILY SITE INSPECTIONS

The UXOSO will be responsible for daily inspections of the project when present. The POSM or the PSHM may make random inspections as warranted.

8.0 SAFETY AND HEALTH EXPECTATIONS, INCENTIVE PROGRAM, AND COMPLIANCE

8.1 GOALS AND OBJECTIVES

The goal for USAE on this project is zero accidents. All managers and supervisors are responsible for implementing the provisions of this APP and attached SHSP and for answering team member questions about accident prevention. Management is responsible for ensuring that all safety and health policies and procedures are clearly communicated and understood by all team members. Managers and supervisors are expected to enforce the rules fairly and uniformly. This will be accomplished by:

- Informing team members of the provisions of the Safety and Health Program
- Evaluating the safety performance of all team members
- Recognizing team members who perform safe and healthful work practices
- Providing training to team members whose safety performance is deficient
- Disciplining team members for failure to comply with safe and healthful work practices.

All team members are responsible for using safe work practices, for following all directives, policies and procedures, and for assisting in maintaining a safe work environment. USAE recognizes that open, two-way communication between management and all team members on health and safety issues are essential to an injury-free, productive workplace. To facilitate a continuous flow of safety and health information between all team members, the following will be accomplished:

- Training all new team members, during the site-specific training, on the site safety and health policies and procedures, which will include this APP and attached SHSP
- Training all new team members on the hazards associated with the job site
- Conducting daily tailgate safety meeting for all team members
- Conducting quarterly refresher-type training
- Posting and, if applicable, distributing safety information
- Encouraging open communications.

8.2 USAE'S CORPORATE SAFETY PROGRAM

USAE's corporate safety program is designed to provide the safety training and tools required to ensure that USAE is providing the safest work environment for its employees, other project personnel, and the general population in areas adjacent to our project sites.

The USAE PSHM and POSM have reviewed the scope of the project and based on this review, have developed this APP designed to protect health and safety during the project.

As part of the job requirements employees are required to:

- Read and follow the APP and attached SHSP
- Attend health and safety meetings, courses and seminars, when available, to make them more informed and aware of potential hazards that exist at the site.

8.3 USAE'S SAFETY INCENTIVE PROGRAM

USAE builds an information database for each project it undertakes, which includes the rate/occurrence of accidents and injuries. Safety data, including injury and accident occurrence, are noted and incentives such as monetary bonuses and additional training courses are provided as rewards for superior employee performance for compliance with the project APP, SHSP, and corporate safety and health policies.

8.4 SAFETY PROGRAM NONCOMPLIANCE POLICIES AND PROCEDURES

USAE management takes seriously employee noncompliance with safety requirements. Personnel not following procedures are warned and counseled in the proper safety procedures, and if the problem persists are again counseled with notations made in their permanent record. Continued noncompliance will lead to termination. On USAE job sites, visitors are briefed about site safety requirements and are provided with the appropriate level of PPE. If visitors refuse to follow these procedures, they will be escorted from the site.

8.5 USAE'S WRITTEN PROCEDURES FOR HOLDING MANAGERS AND SUPERVISORS ACCOUNTABLE FOR SAFETY

USAE's commitment to safety and health is documented and required from the time an offer is made to a job applicant. Managers and supervisors are made responsible for enforcing safety and health as part of their job descriptions. They are ultimately responsible for protecting the welfare of the employees as well as minimizing the potential liability associated with on the job accidents.

9.0 ACCIDENT REPORTING

This section provides the requirements for implementing the accident reporting provisions of EM 385-1-1. This APP requirement applies to all work performed by USAE for each project.

USAE Project Manager and the USAE POSM will be notified immediately by telephone of any accidents, and will follow-up with USAE's Accident Report Form (see Attachment 7). USAE's Site Manager will notify the Navy technical representative immediately and fill out and submit the Contractor Significant Incident Report form (CSIR-1) to the Contracting Officer or designated representative for review within one working day after the event. USAE will thoroughly investigate all accidents.

Person(s) who become ill or injured during work activities must immediately inform the SUXOS or UXOSO, regardless of the severity of the illness or injury. The victim(s) will be decontaminated if the injury occurred in containment areas. In the event that the medical emergency is severe enough, the SUXOS or UXOSO will order a cessation of work and notify off-site emergency personnel. All personnel at the work site will use the buddy system, staying within sight of their partner. If a partner becomes incapacitated or severely ill, an ambulance will be called. In the event that a cessation of work is ordered, all personnel should:

- Assist the UXOSO, if required, in decontaminating the victim and/or administering first aid
- Leave the contaminated area and undergo decontamination prior to entering the worker rest area
- Assist emergency response personnel when requested.

In the event of an accident that results in a lost workday or $2,000 or more in property damage, an accident report will be completed and submitted within five workdays, and a copy will be provided to the client contact.

All workers receiving medical treatment, other than first aid, by a medical professional will obtain a medical release on the date of treatment stating one of the following: (1) the employee is not fit for duty; (2) the employee is fit for restricted duty; or (3) the employee is fit for duty. A copy of the release will be attached to the accident report and submitted to the client Project Officer.

9.1 EXPOSURE DATA

All work related incidents occurring to USAE employees should be reported for statistical purposes. All recordable incidents count against USAE's recordable incident experience when they occur, to either an employee or a subcontractor working under the direct supervision of USAE's Site Manager. Personnel man-hours will be defined as hours worked by all persons assigned to the project including subcontractor employees under direct supervision of USAE's Site Manager. These man-hours will be annotated on the Daily Operations Summary and/or the Weekly Operations Summary forms (see Appendix F of this Work Plan for forms) and transmitted to the Project Manager. The USAE UXOSO will document and review with the POSM and PSHM the potential exposure data versus the man-hours worked per day to evaluate the association to site accidents or injury. The most current OSHA 300 form will be posted on site and is presented in Attachment 1 of this APP.

9.2 ACCIDENT INVESTIGATIONS, REPORTS, AND LOGS

Investigation and documentation of emergency responses shall be initiated by the UXOSO. This is important in all cases, but especially so when the incident has resulted in personal injury, property damage, or environmental impact. The documentation will be a written report and will be inclusive of the following:

- Accurate, concise and objectively recorded information
- Authentic Information: Each person making an entry must sign and date that entry. Nothing is to be removed or erased. If details are changed or revised, the person making the change should strike out the old material with a single line and initial and date the change.
- Titles and names of personnel involved
- Actions taken, decisions made, orders given, to whom, by whom, when, what, where, and how, as appropriate
- Summary of data available
- Possible exposure of personnel
- Copies of the Employer's Report of Occupational Injury or Illness (OSHA 300) or the USAE Accident Report, as appropriate will be completed and forwarded to the POSM.

All accidents will be investigated and immediate steps will be taken to prevent recurrence. The client will be notified of any accidents occurring on this project site. Should an accident occur on the site, all reports and records will be documented. Copies will be maintained on site for the duration of site activities. A permanent copy will be maintained in the USAE Corporate Office.

9.3 IMMEDIATE NOTIFICATION OF ACCIDENTS

An accident that appears to have any of the consequences listed below shall be immediately reported to the Navy Remedial Project Manager in person, telephonically, or by email. Should we be unable to get through to the Navy Project Manager immediately, USAE will continue to try to reach him until we receive an acknowledgement that he has received the message. The reporting requirement of submitting an incident report still applies.

- A fatal injury
- Permanent total disabling injury
- Permanent partial disabling injury
- Three or more persons admitted to a hospital
- Property damage in the amount of $100,000 or more.

10.0 MEDICAL SUPPORT

USAE will have an EMT and two persons assigned to the site who are certified in first aid and CPR. They will also have current blood-borne pathogen training and will be on site for the duration of site activities. These will be the first responders to a site accident. Other site workers may be asked to assist these workers as necessary. If a worker has a potentially serious injury or illness, the UXOSO in consultation with the EMT will make the decision to call in professional medical assistance. An ambulance will be called in to transport the victim to the nearest hospital. For less serious injuries, a co-worker may take a victim for medical treatment to the nearest hospital emergency room. For serious injuries, the medical treatment facility for use at this project site will be the Castle Medical Center in Kailua, HI. The medical clinic is approximately 8 miles away from the site.

The USAE Occupational Physician will be available to provide patient specific information in case medical treatment is needed. Dr. James Vawter of Tierney-Vawter Medical Group can be reached at telephone number (831) 647-8700.

The EMT and the UXOSO will maintain a first aid kit and blood-borne pathogens kit in their transport vehicles on the site. Personnel with first-aid type injuries will also report to the UXOSO, who will instruct the first responders to provide first aid treatment of their injuries. The UXOSO will be advised of any first aid treatment provided, so that he may investigate to the root cause of the injury and take preventive action on the site.

11.0 PERSONAL PROTECTIVE EQUIPMENT

When feasible, engineering controls and work practices, or a combination thereof, shall be utilized to protect site workers from safety and health hazards and to maintain personal exposures to hazardous substances below established exposure limits. The exposure limits used by USAE will be the lower of the OSHA Permissible Exposure Limits (PEL) found in 29 CFR 1910 Subpart G and 29 CFR 1910.1000, or the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV). Other recognized published exposure levels, such as those found on MSDSs, will be used if the substance is not listed by OSHA or the ACGIH. USAE will not utilize a system of employee rotation as a means of complying with the PPE, PEL, TLV or other published limits.

11.1 TYPES OF PPE

Requirements for task and activity-specific levels of protective clothing are presented on the Activity Hazard Analyses located in the SHSP of this APP. Personnel performing site tasks shall use the appropriate level and type of PPE specified in this plan for each individual task. This APP makes provisions for use of the following levels of PPE, in accordance with the hazards and contamination level anticipated for each task or operation: Level A, Level B, Level C, and Level D. The following sections describe the PPE requirements for activities and locations on the site.

11.1.1 LEVEL A PROTECTION

Level A Protection is not required.

11.1.2 LEVEL B PROTECTION

Level B Protection is not required.

11.1.3 LEVEL C PROTECTION

Level C Protection is not required.

11.1.4 LEVEL D PROTECTION

The minimal level of protection that will be required of USAE personnel and visitors at the site will be Level D. The UXOSO may increase the level of protection due to changing requirements but may not decrease the level of protection without approval of corporate safety management. The following equipment will be used for Level D protection:

- Hard hat, in the vicinity of vegetation clearance operations
- Face shield, in the vicinity of vegetation clearance operations
- Leather gloves
- Safety glasses with side shields or safety goggles, in the vicinity of vegetation clearance operations
- Hearing protection, where required by high noise levels, in the vicinity of vegetation clearance operations
- Leather work boots with ankle support and non-slip soles. No steel toe shoes in the vicinity of magnetometer operations
- Cotton work clothes or coveralls
- Back supports (optional)
- Leg chaps – when working around vegetation removal equipment
- High-visibility reflective safety vest (meeting the requirements of ANSI/ISEA 107-1999 or later).

11.1.4.1 Eye Protection

All personnel shall use appropriate eye protection when exposed to eye hazards from flying particles, liquid chemicals, or other eye hazards. All personnel shall use eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g., clip-on or slide-on side shields) meeting the pertinent requirements of this section are acceptable.

- All personnel who wear prescription lenses while engaged in operations that involve eye hazards shall wear eye protection that incorporates the prescription in its design, or wear eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.
- Eye protection shall be distinctly marked to facilitate identification of the manufacturer.

Protective eye equipment purchased after July 5, 1994 shall comply with ANSI Z87.1-1989, “American National Standard Practice for Occupational and Educational Eye and Face Protection,” which is incorporated by reference as specified in Section 1910.6.

11.1.4.2 Head Protection

When working in the vicinity of vegetation clearance equipment, hard hats will be worn.

11.1.4.3 Leg Protection

Leg chaps will be worn during vegetation clearance operations.

11.1.4.4 Foot Protection

Due to the uneven working surfaces and potential for tripping hazards, all USAE personnel shall wear sturdy leather work boots with ankle support and non-slip soles. Personnel using magnetometers for the detection of buried MEC will not wear steel-toe safety shoes, as they will affect the readings of the equipment.

11.1.4.5 Hand Protection

USAE selects and requires employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; thermal burns; and harmful temperature extremes. For most operations on this site, leather gloves will provide adequate protection against minor cuts, which are a hazard in most site operations. Chemical gloves will be required in fueling operations.

11.1.4.6 Hearing Protection

USAE shall make hearing protectors available to all employees exposed to an 8-hour time-weighted average of 85 dB or greater. Hearing protectors shall be replaced as necessary. Hearing protection will be required for all personnel working in and around any operations likely to produce high noise levels, such as during the use of chain saws and weed-eaters during vegetation clearance operations.

11.2 PROPER PPE SELECTION

Each task outlined in the Statement of Work has been assessed to determine the risk of personnel exposure to safety and health hazards, which may be encountered during its conduct. The hazard assessment is based on available information pertaining to the historical use of the site, site contaminant characterization data and the anticipated operational hazards. This information has been provided by the client, or collected by USAE site personnel. The PPE assigned as a result of the hazard assessment represents the minimum PPE to be used during initial site activities. Since hazard/risk assessment is a continuing process, changes in the initial types and levels of PPE will be made in accordance with information obtained from the actual implementation of site operations and data derived from the site monitoring. As a general rule, the levels of PPE will need to be reassessed if any of the following occur:

- Commencement of a new work phase, such as the start of drum sampling or work that begins on a different portion of the site
- Change in job tasks during a work phase
- Change of season/weather
- When temperature extremes or individual medical considerations limit the effectiveness of PPE
- Contaminants other than those previously identified are encountered
- Change in ambient levels of contaminants
- Change in work scope, which affects the degree of contact with contaminants.

During the selection of PPE, the POSM and UXOSO will also take into consideration the following factors:

- Limitations of the equipment
- Work mission duration
- Temperature extremes
- Material flexibility
- Durability/Integrity of the equipment.

11.3 UPGRADING/DOWNGRADING PPE

If work tasks are added or amended after completion and approval of the APP/SHSP, the UXOSO will conduct the task hazard assessment and consult with the POSM and/or the PSHM. The level and type of PPE to be used will be identified. The UXOSO can increase the level of PPE when the situation warrants, due to an increase in hazardous exposure. Any decreases in the level of PPE must be approved by the POSM and/or PSHM, only after review of documentation demonstrating that the conditions and/or potential for hazardous exposure are reduced enough to justify the downgrade.

11.4 GENERAL REQUIREMENTS

All personal protective equipment shall be provided, used, and maintained in a sanitary and reliable condition where it is necessary. PPE is required due to hazards of processes or environment, chemical hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact. All PPE will be used in the manner for which it was designed. The assignment of PPE will be based upon hazard analysis, and the equipment will be selected based on its protection factor against site hazards.

11.5 INSPECTIONS

Each piece of PPE will be inspected daily prior to use. Defective or damaged personal protective equipment shall not be used. It shall be removed from service and turned in for repair, or removed from the site for disposal and replaced with new PPE. During the work task, buddy teams should periodically inspect each other's PPE for evidence of chemical attack, such as discoloration, swelling, stiffening, or softening.

11.6 CLEANING AND DECONTAMINATION

The UXOSO will be responsible for ensuring that PPE is in good, clean, working order prior to issuing the PPE the first time. Once issued, site personnel will ensure that re-usable articles of PPE are maintained in a clean and sanitary fashion. For items used inside an EZ, site personnel will follow the requirements of the Site Specific Decontamination Plan and ensure that the PPE is properly decontaminated before removing the item from the EZ or Contaminant Reduction Zone.

11.7 MAINTENANCE

Maintenance of PPE can vary greatly, based upon the complexity of the PPE and the intricacy of the repair involved. The UXOSO will become familiar with the manufacturer's recommended maintenance and when possible repair defective PPE. If unable or unauthorized to conduct the repair, the UXOSO will return the item to the manufacturer for repair, or procure a replacement.

11.8 STORAGE

PPE will be stored in a location, which is protected from the harmful effects of sunlight, damaging chemicals, moisture, extreme temperatures, impact, or crushing. If needed, the UXOSO will designate a specified area for the storage of PPE.

11.9 PPE PROGRAM EFFECTIVENESS

Based on the inhalation hazard and potential chemical exposures on this site, Level D PPE is considered adequate for the work that is to be accomplished at the site. If work tasks are added to the SOW after approval of this APP, the SUXOS and/or UXOSO (as applicable) shall identify and assess the task hazards and relay that information to the POSM and PSHM. The POSM will prepare an amendment to the APP and submit the amendment for approval from the Navy. The amendment will be added to the APP upon Navy approval.

The UXOSO will ensure PPE use complies with all applicable OSHA, USACE, and USAE requirements. It is the responsibility of each employee to report to work wearing proper attire and to assemble the necessary PPE prior to initiating donning procedures.

11.10 TRAINING

USAE shall provide training to each employee who is required by this section to use PPE. Each affected employee shall demonstrate an understanding of the training, and the ability to use PPE properly, before being allowed to perform work requiring the use of PPE. Each such employee shall be trained to know at least the following:

- The decisions and justifications used to select each piece of PPE
- The nature of the hazards and the consequences of not using PPE
- What PPE will be required for the conduct of each task
- When PPE will be required during the performance of each task
- How to properly don, doff, adjust, and wear each piece of PPE
- The proper inspection, cleaning, decontaminating, maintenance, and storage of each PPE item used
- The limitations of the PPE.

All personnel receiving PPE training will be required to demonstrate an understanding of the training topics and the ability to correctly use the PPE. This will be accomplished through the UXOSO supervising and visually inspecting each individual's ability to properly don and use the PPE during initial use of the PPE.

When the UXOSO has reason to believe that any affected employee who has already been trained does not have the understanding and skill required he should retrain each such employee. Circumstances where retraining is required include, but are not limited to, situations where:

- Changes in the workplace render previous training obsolete
- Changes in the types of PPE to be used render previous training obsolete
- Inadequacies in an affected employee's knowledge or use of assigned PPE indicate that the employee has not retained the requisite understanding or skill.

Upon completion of the training and after each employee has successfully demonstrated the requisite understanding, the UXOSO will complete the Training form (see Table 11-1). This identifies: the employees who attended the training course and successfully demonstrated the required knowledge; the date(s) of the training and demonstration session(s); and the PPE covered by the training session.

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Table 11-1: USAE Certification of PPE Training

SITE INFORMATION			
Site Name:			
Location:		**Instructor(s):**	
Date of Classroom Instruction:		**Date of Demonstration:**	
PPE TRAINING COURSE ATTENDANTS			
The following personnel have attended the site PPE training course, and demonstrated, through use, an understanding of the donning/doffing procedures, inspection, cleaning, maintenance, storage, limitations, and proper disposal of the PPE listed on this certificate. These personnel are now qualified to use the site- and task-specific PPE, as required by the SHSP.			
Name	**Organization**	**Name**	**Organization**

TYPES AND LEVELS OF PPE ADDRESSED DURING TRAINING			
Trainer's Initials	**Personal Protective Equipment Reviewed**	**Trainer's Initials**	**Personal Protective Equipment Reviewed**

CERTIFICATION		
I the undersigned do hereby certify that the above listed personnel have received the requisite training and successfully demonstrated their ability to use the PPE listed above, in accordance with the USAE Personal Protective Equipment Program.		
Name (printed):	Signature:	Date:

12.0 PLANS, PROGRAMS, AND PROCEDURES

The following subsections describe the plans, programs, and procedures that will be used during site operations.

12.1 LAYOUT PLANS

Layout plans are not applicable for this Project, as temporary structures will not be constructed.

12.2 EMERGENCY RESPONSE PLAN AND CONTINGENCY PROCEDURES

The UXOSO will perform pre-emergency planning before starting field activities and during the mobilization and site-specific training phase of the project, and will coordinate emergency response with police/fire/rescue personnel and the nearest hospital. Pre-emergency planning meetings shall be used to inform local authorities of the nature of site activities that will be performed under the SOW and the potential hazards that activities may pose to site workers, the environment, and the public. All emergency response telephone numbers will be verified prior to the start of site activities. Section 12.2.16 provides information on fire, medical and other emergency support agency contacts/telephone numbers.

12.2.1 PROCEDURES AND TESTS

An agreement will be established between USAE and emergency response personnel and the hospital regarding responsibilities of each party in responding to a project site emergency. The UXOSO will verify all on-site emergency services information, to include procedures for requesting services. It shall be the UXOSO's responsibility to post these procedures and contact information in accordance with the requirements of this APP/SHSP. Pre-emergency planning tasks include:

- Post emergency instructions and call numbers at accessible telephone locations
- Inspect all emergency equipment and supplies to ensure they are in proper working order
- Provide a site map marked with planned evacuation routes, assembly points, and emergency equipment and supplies
- Provide a map with the route to the hospital marked and highlighted, with copies of this map posted in all site vehicles
- Conduct an emergency response drill to test the effectiveness of the Emergency Response Plan and Contingency Procedures (ERCP)
- Review and revise the ERCP in the event of a failure of the plan in an actual or staged emergency, or when changes in site conditions or scope of work affect the ERCP
- Before normal activities are resumed, onsite personnel must be prepared and equipped to handle another emergency. These follow-up activities should be completed.
- The POSM will notify appropriate government agencies as required (Reminder: OSHA must be notified if there have been any fatalities or three or more hospitalizations).
- All equipment and supplies restocked, serviced and inspected.
- Review and revise all aspects of the SHSP as necessary to address and prevent future emergencies of this type.

As part of mobilization training, prior to start of project, all personnel will review the points of contact list and where it is posted as well as location of the nearest hospital. A meeting place off site will be identified in case of emergency evacuation and the responsibilities of all persons on site.

- All personnel will review the locations of fire extinguishers and be competent to use one properly.

- All emergency telephone numbers will be posted next to the directions to the hospital map on site.

12.2.2 POTENTIAL SITE EMERGENCIES

There are several emergencies, which could reasonably be anticipated during project activities, including:

- Thermal stress
- Worker injuries, slips, trips or falls, and/or illness
- Fires and explosions.

12.2.3 PERSONNEL AND LINES OF AUTHORITY

In the event of an emergency, the UXOSO will be designated as the On-Scene Incident Commander and will have the overall responsibility for implementation of the ERCP and coordination with responding off site emergency services. In the event of a medical emergency, the UXOSO will call in the EMT and in consultation with the UXOSO will determine if professional medical assistance is required and will summon emergency response personnel as required.

Specific responsibilities of the UXOSO include, but are not limited to, the following:

- Notifying local police, fire department, and other off-site emergency units, as required
- Notifying the Navy PM and providing updates as conditions change
- Directing offsite emergency response personnel to the scene and providing assistance
- Site control
- Completing any follow-up reports
- Rescuing personnel
- Accounting for all site personnel and visitors
- Providing for emergency first aid
- Preventing further injury of personnel
- Providing current status of the incident to the USAE POSM and/or PSHM
- Ensuring that on-site emergency response personnel don the proper PPE if needed
- Assisting on-site emergency response personnel with treatment and transport of sick/injured
- Providing medical background information of the sick/injured and applicable site health and safety information to the off-site emergency medical responders
- Accompanying sick/injured personnel to hospital.

If the emergency involves employee injury, UXOSO will complete the USAE Accident Report. The PSHM will be responsible for notifying applicable Federal, state and local authorities/agencies. Once the emergency has been resolved, the UXOSO, Program Manager and Program Safety and Health Manager will conduct a follow-up investigation and critique. Actions will be taken to prevent recurrence.

All USAE personnel and visitors will be responsible for:

- Reporting any site emergencies to the SUXOS or UXOSO
- Knowing the exit location and evacuation route within the EZ
- Knowing the pre-planned evacuation assembly point and going there in the event of an emergency
- Assisting emergency response personnel as requested.

12.2.4 EMERGENCY RECOGNITION AND PREVENTION

An emergency is an unplanned event that threatens the safety of any personnel. Compliance with this APP can assist in the prevention of anticipated site emergencies. These emergency situations can easily be recognized by visual observations, worker complaints, or monitoring instruments.

Prevention of emergencies will be aided by the effective implementation of this APP and Site Specific Health and Safety Plan, personnel awareness, contingency planning, and on site safety meetings. Anticipated emergencies may include physical injury, illness, fire, explosion, chemical spill or release, inclement weather, and natural disasters. The UXOSO will use the site-specific briefing and/or the Tailgate Safety Briefings to inform site workers of the recognition, prevention, and response procedures for each anticipated emergency.

In the event of an emergency, site personnel will be notified by either an alarm or verbal communication. Personnel will be notified to:

- Stop work activities
- Evacuate to the designated assembly point at the support zone
- Begin emergency procedures
- Notify off-site emergency response organizations.

After evacuation, the UXOSO will account for all personnel, ascertain information about the emergency and advise responding onsite personnel. The UXOSO will contact, advise and coordinate with responding off-site emergency personnel if deemed necessary by the situation.

In all situations that require evacuation, personnel shall not re-enter the work area until:

- The conditions causing the emergency have been corrected.
- The hazard has been reassessed.
- The Site Specific Health and Safety Plan has been revised and reviewed with on-site personnel, if needed.
- Instructions have been given for authorized re-entry by the UXOSO.

At the conclusion of any site emergency procedures drill, or an actual site emergency, the Site Managers will critique the situation to ensure that the procedures in place were effective and make changes in areas that may be ineffective.

12.2.5 SAFE DISTANCES AND PLACES OF REFUGE

The UXOSO will determine safe distances and places of refuge. Prior to the start of each workday, the UXOSO or SUXOS (as applicable) will hold a safety meeting with all personnel and discuss the following:

- Times when the gate to ranges may be locked
- Who has the gate key or combination on site
- Evacuation routes from work areas
- The assembly point to be used in the event of an emergency
- Locations of the nearest fire extinguishers and spill containment equipment
- Discussion on specific health and safety concerns of personnel.

12.2.6 EVACUATION PROCEDURES

The UXOSO will establish evacuation routes. Evacuation notification will be one long blast on an air horn, vehicle horn, or direct verbal communication. If evacuation is necessary, all personnel are to:

- Gather equipment to the extent safely possible
- Evacuate to the vehicle(s) location and prepare to move out.

12.2.7 MEDICAL EMERGENCY PROCEDURES

Any person(s) who become ill or injured during work activities must immediately inform the UXOSO regardless of the severity of the illness or injury. The UXOSO will alert the EMT to assist the victim. If the injury or illness requires more advanced medical attention, the UXOSO will summon emergency medical assistance and the ambulance will transport the victim to the hospital. All personnel at the work site will use the buddy system. All personnel using the buddy system will stay within sight of their partner. If a partner becomes incapacitated or severely ill, the UXOSO will be called. In the event that a cessation of work is ordered, all personnel should:

- Assist the EMT if required, in administering first aid
- Leave the area if the hazard warrants such action.

If the medical emergency is not severe (requiring only first aid), the victim will be treated on site by the EMT, with additional treatment at the hospital if required. If the medical emergency is serious, the victim would be brought to the hospital via ambulance, where the victim would be stabilized and treated. The UXOSO will provide the ambulance and hospital personnel with the victim's medical background information and information on how the injury or illness occurred.

It is not anticipated that hazardous waste decontamination shall be required during any activities under the SOW. This determination has been made based upon archival documentation and past activities conducted at the site. Basic cleaning and disinfection is all that will be required prior to most types of treatment. If a worker is accidentally injured using chemicals brought onto the site, the first aid procedures described in the MSDS would be followed by the EMT to clean as much of the chemical off as possible before treatment.

12.2.8 BLOOD-BORNE PATHOGENS PROGRAM

The strategy of "Universal Precautions" was developed by the Centers for Disease Control to address concerns regarding transmission of Human Immunodeficiency Virus (HIV). This concept stresses that all sources should be assumed to be infectious for HIV, Hepatitis B virus, and other blood-borne pathogens. The philosophy of universal precautions shall be applied whenever USAE employees render first aid involving potential contact with blood, body fluids, or other potentially infectious materials. All blood and body fluids will be treated as if they are infectious. PPE and clean-up procedures will be implemented accordingly. The EMT and a minimum of two personnel certified in First Aid/CPR will also have current blood-borne pathogens training and will be on site for the duration of site activities.

12.2.8.1 Engineering Controls

Engineering controls will be used whenever possible to eliminate or reduce the potential for employee exposure, and will be periodically examined, maintained or replaced to ensure their effectiveness. USAE employees shall observe "universal precautions," and treat all body fluids as potentially infectious materials. USAE shall provide hand-washing facilities readily accessible to employees. Where the installation of hand washing facilities is not feasible, appropriate antiseptic cleanser and clean paper or cloth towels shall be provided. USAE employees shall wash their hands and any other potentially exposed skin with soap and running water as soon as possible:

- After removing gloves or other personal protective equipment
- After contact with potentially infectious materials
- Even after washing with antiseptic as described

- USAE employees shall flush eyes or other mucous membranes with copious amounts of water as soon as possible after contact of these areas with potentially infectious materials.

For emergency first aid situations involving multiple victims, equipment shall not be used on different victims unless it has been properly decontaminated or if the victim's medical condition would be seriously affected by a delay in treatment.

12.2.8.2 Safe Work Practices

Safe work practices will be implemented whenever possible to eliminate or reduce the potential for employee exposure. Employees shall wash their hands immediately or as soon as feasible after removal of gloves or other PPE. Employees shall wash hands and any other skin with soap and water, or flush mucous membranes with water immediately following contact with blood or potentially infectious materials.

If potentially contaminated sharps are encountered, the item shall immediately be disposed of in an appropriate puncture-proof container or decontaminated.

Eating, drinking, smoking, applying cosmetics or lip balm, handling of contact lenses, any hand-to-face activities, or storage/handling of food is prohibited in all areas where potentially infectious materials are present.

Equipment that has become contaminated will be decontaminated prior to servicing or storage, unless decontamination is not feasible, in which case the equipment will be disposed of properly in appropriately labeled and color-coded containers.

12.2.8.3 Personal Protective Equipment

When occupational exposures remain after the implementation of engineering and work practice controls, appropriate PPE will be utilized to control employee exposures.

USAE shall provide appropriate PPE including gloves, face masks, eye protection, mouthpieces, etc., for protection against potentially infectious materials.

Personal protective equipment shall not allow potentially infectious materials to pass through or reach an employee's clothes, skin, eyes, mouth, or other mucous membranes during normal use for the expected duration of time for which the PPE will be used.

Employees shall use the appropriate personal protective equipment unless, in unusual circumstances, the employee believes that using the protective equipment will prevent the administering of first aid or would pose an increased risk. Any incident where the use of protective equipment is declined shall be investigated and documented by the UXOSO and be approved by the POSM.

Single-use protective equipment, such as surgical gloves, shall be disposed of after each use, or as soon as possible after the equipment has become damaged.

Multi-use protective equipment, such as coveralls or utility gloves, shall be cleaned and decontaminated after each use or when they become contaminated in order to maintain its effectiveness.

Multi-use protective equipment shall be removed, then disposed of or repaired as soon as possible after becoming damaged.

When PPE is removed, it will be placed in an appropriately designated area or container for storage, washing, decontamination or disposal. PPE will be removed and disposed or decontaminated before leaving the area.

Gloves will be worn when it can be reasonably anticipated that the employee may have hand contact with potentially infectious materials.

Disposable (single use) gloves will not be washed for reuse and will be disposed of after each use or if their ability to function as a barrier is compromised.

Utility gloves may be decontaminated for re-use if the integrity of the glove is not compromised. However, they must be discarded if they exhibit signs of deterioration or when their ability to function as a barrier is compromised.

Masks in combination with eye protection devices, such as safety glasses, goggles or face shields, will be worn whenever blood or other potentially infectious materials may be generated and eye, nose, or mouth contamination can be reasonably anticipated.

12.2.8.4 Decontamination Procedures

All equipment, working surfaces and non-working surfaces shall be decontaminated after contact with potentially infectious materials. A solution of ten parts water to one part bleach or equally effective material shall be used to clean contaminated areas.

Contaminated sharp objects shall be cleaned up using mechanical means, such as a brush and dustpan. Sharp objects shall not be picked up directly with the hands.

Two pairs of gloves, inner surgical gloves and outer utility gloves shall be worn for cleaning contaminated surfaces. A smock or apron and eye protection shall also be worn.

Only those employees directly involved with the decontamination efforts shall be allowed in the work area while cleaning is taking place.

All cleaning equipment shall be disinfected or disposed of in accordance with this Program.

For minor injuries where the employee is able to return to work, the injured employee shall clean up their own blood or other potentially infectious materials.

While this section deals primarily with decontamination of blood-borne pathogens, it is important to note that any injured employee who has been exposed to any type of chemical contamination will undergo as much decontamination as practical before being turned over to the ambulance crew. If contamination is remaining, the patient will be wrapped in a blanket to prevent the spread of contamination and the ambulance crew will be advised of the potential hazards.

12.2.8.5 Housekeeping and Waste Disposal

The work site will be maintained in a clean and sanitary condition to prevent the spread of contamination to other areas of the facility. All equipment and working surfaces will be cleaned and decontaminated after contact with blood or other potentially infectious materials. Contaminated work surfaces and equipment shall be decontaminated with an appropriate disinfectant immediately after they become contaminated in accordance with the decontamination section of this program. Regulated waste, other than contaminated sharps, shall be placed in containers which are: closable, constructed to contain all contents and prevent leakage, properly labeled or color-coded, and closed prior to removal or replacement. Labels or color-coding shall be fluorescent orange or orange-red, and display the biohazard symbol in a contrasting color.

Regulated waste containing contaminated sharps will be placed in containers which are: closable, puncture resistant and leak proof on sides and bottom, properly labeled or color-coded, and closed prior to removal or replacement. Contaminated clothing, equipment and other materials shall be handled as little as possible and with minimum agitation. Bags containing contaminated materials shall not be carried or handled from the bottom. All regulated waste will be disposed of in accordance with applicable federal, state, and local regulations.

12.2.9 EMERGENCY MEDICAL FACILITIES

For most anticipated types of on-site injuries, site personnel will report to the UXOSO, who will summon the EMT to examine the injury and provide first aid treatment. In cases of more serious injuries or illnesses, the victim will still report to the UXOSO (or he will be summoned to the victim) and the UXOSO will examine the victim and consult with the EMT to determine if further medical treatment is indicated. If required, the UXOSO will summon an ambulance to transport the victim to the nearest hospital, which is Castle Medical Center, 640 Ulukahiki Street, Kailua, HI.

12.2.9.1 Directions to Hospital

This section provides a map and directions to the Castle Medical Center, located at 640 Ulukahiki Street, Kailua, HI. The emergency room phone number is (808) 263-5164. The outpatient clinic phone number is (808) 263-5174.

Mile	Instruction	For
0.0	**Depart Waikane on Local road(s) (East)**	0.2 mi
0.2	Turn RIGHT (South) onto SR-83 [Kamehameha Hwy]	8.0 mi
8.2	Road name changes to Local road(s)	21 yds
8.2	Turn LEFT (East) onto SR-83 [Likelike Hwy]	0.4 mi
8.7	Take Local road(s) (RIGHT) onto SR-83 [Kamehameha Hwy]	2.4 mi
11.1	Road name changes to Local road(s)	21 yds
11.1	Turn LEFT (North-East) onto SR-61 [Kalanianaole Hwy]	1.8 mi
12.9	Turn LEFT (West) onto Local road(s)	21 yds
12.9	Keep STRAIGHT onto Ulukahiki St	142 yds
13.0	**Arrive Castle Medical Center [640 Ulukahiki St, Kailua, HI 96734]**	

12.2.10 CRITERIA FOR ALERTING THE LOCAL COMMUNITY RESPONDERS

In the event of an on-site emergency the individual team leader or first person aware of the emergency will contact the UXOSO by field radio, cellular telephone, or in person, as circumstances allow. The UXOSO will normally be responsible for contacting the EMT to administer first aid services and the ambulance to transport the victim to the hospital, should that be needed. If the order is given to evacuate the site of all personnel, each on-site team leader will assemble, account for, and evacuate all team personnel to the pre-designated staging area in the support zone. The EMT will render emergency first aid treatment and the UXOSO will authorize site personnel to assist, where required. There is a military Fire Department at the Marine Corps Base Hawaii and a local volunteer Fire Department at Kaneohe, and should circumstances warrant their assistance, they would be called by the UXOSO. The UXOSO will assure that the Fire Departments, if called to the site, do not approach any closer than 235 feet from the fire.

12.2.11 MATERIAL SAFETY DATA SHEETS

As part of the USAE Hazard Communication Program, an MSDS binder will be maintained on site, which includes copies of MSDSs for all hazardous materials brought onto the site by USAE. It will be kept in the SUXOS site vehicle during operations. This MSDS binder will be available on request to all site personnel during all working hours of the site. If site workers have further questions about any of the hazardous materials they come into contact with, the USAE UXOSO or the Program Safety and Health Manager will locate the required information and pass it on to the employee. If an employee is injured as a result of exposure to a chemical onsite, that MSDS will be retrieved and given to the medical providers.

12.2.12 TRAINING

Training in emergency procedures will be accomplished by performing drills. After any drill or real emergency scenario, the Project Manager, Program Safety and Health Manager, and UXOSO will evaluate the situation and determine any potential areas for improvement in the procedures. Procedures will be updated accordingly.

12.2.13 SPILL PLANS

USAE will conduct cleanup operations in the event of a spill of hazardous material (e.g., fuel or oil from UXO field operations). The UXOSO will manage the collection of the spilled material with absorbent pads and containerize the pads or materials within Department of Transportation approved drums for disposal as potential contaminated hazardous waste. A complete spill kit will be maintained on site when spills are a potential hazard.

In the event of a spill or leak of any potentially harmful material (regardless of quantity), on-site personnel will:

- Notify the UXOSO immediately.
- The UXOSO shall notify the Project Manager of the spill/leak with relative information (location, time, chemical identity, quantity, hazards listed on the MSDS), and any corrective actions/measures taken.
- Locate the source and stop the leak/spill if it can be done safely (as dictated by the UXOSO).
- Begin containment and recovery of spilled material (as directed by the UXOSO), using appropriate PPE and spill clean-up equipment and materials.
- Once notified, the Project Manager will in turn notify the Client Project Manager and the Contracting Officer. The Client Project Manager will advise USAE if any additional actions are necessary.

- At the end of an emergency procedures drill or an actual emergency, the site managers will critique the situation in order to determine if the procedures were effective in addressing the site needs. In areas where problems occurred, they will re-evaluate the procedures to make them more effective.

12.2.14 FIREFIGHTING PLANS

In the event of a fire or explosion, the UXOSO will notify the police, fire department, and ambulance, as required. The UXOSO will also contact the Navy site representative and the Navy Project Manager, and escort the response personnel to the location of the fire or explosion. Site personnel will not fight fires, but will exit the project area and gather at the predetermined rally location. The responding fire department personnel will be informed of the nature of the fire and, if explosives are present, the fragmentation distance from which to fight or contain the fire.

12.2.14.1 Small Fires

A small fire is defined as a fire that can most likely be extinguished by site personnel using portable extinguishers. A small fire must also be free and clear of explosive materials, especially MEC. If a small fire occurs, the UXOSO will direct site personnel to perform the following, if safe to do so:

- Evacuate unnecessary personnel to an upwind position.
- Attempt to extinguish the fire using portable fire extinguishers or by smothering.
- Remove any essential or flammable items from the path of the fire.
- Notify emergency response services (fire, police, ambulance, hospital, etc.) as needed.

If a fire extinguisher is used, this must be immediately reported to the UXOSO. The fire extinguisher must be immediately removed from service until it can be recharged. Another fire extinguisher must be made available to the operating area. The area around where the fire occurred must be watched for a minimum of 30 minutes after the fire has been extinguished to assure re-ignition does not occur. If personnel are not working in the area, the UXOSO should check the area of the fire periodically to assure re-ignition does not occur.

12.2.14.2 Large Fires

A large fire is defined as a fire, which cannot be extinguished, or which, due to its size, cannot be extinguished using portable fire extinguishers. In the event that a large fire occurs and the fire does not involve explosive materials, the UXOSO will direct personnel to conduct the following, if safe to do so:

- Evacuate all non-essential personnel from the site to an upwind location.
- Notify the Fire Department and other emergency response services (police, ambulance, hospital, etc.) as needed.
- Order the appropriate level of protective equipment to be worn by personnel responding to the fire.
- Attempt to control the fire to the extent possible.
- Remove any essential or flammable items from the path of the fire.

12.2.14.3 Fires Involving Explosive Materials

If a fire occurs that involves explosive materials such as chemicals, fuels or MEC, the UXOSO will order the immediate evacuation of all site personnel to an upwind assembly point at least fragmentation distance from the fire site. The UXOSO will then notify the Fire Department and any other emergency services (police, ambulance, hospital, etc.) as needed. At no time will USAE personnel fight a fire involving explosive materials, nor will they allow outside emergency personnel to do so. The Fire Department personnel may not enter any closer than fragmentation distance from the fire and they may spray water to surrounding buildings or structures in order to prevent the spread of fire.

After the fire has burned itself out, the site must be barricaded and entry prohibited until adequate cooling time has passed (at least 24 hours for a large fire). Explosive materials that may not have discharged during the fire may still be liable to function in the presence of extreme heat. After the site has cooled down, the SUXOS and UXOSO will inspect the site. Any MEC that is observed on the surface will be considered unsafe to move and will be blown in place. All MEC must be destroyed in place before non-UXO qualified personnel are permitted to enter the area.

If non-UXO qualified personnel must enter the site for purposes of fire investigation, they must receive a briefing on the potential hazards of MEC on the site. They must be accompanied at all times by a UXO-qualified employee of USAE. NO OUTSIDE PERSONNEL WILL BE PERMITTED ONTO THE SITE WHILE THERE IS A KNOWN MEC HAZARD PRESENT. If during the course of the investigation MEC is observed, the site will be evacuated of all non-UXO qualified personnel until the site can be rendered safe for re-entry.

12.2.14.4 Explosions

In the event of an explosion, the UXOSO will order the evacuation of all site personnel to a safe, upwind assembly point at least fragmentation distance away. The UXOSO will then notify all necessary emergency response services. After an explosion has occurred the site will remain barricaded a minimum of 30 minutes before entry is permitted. The UXOSO will enter the site with a team member and inspect for presence and condition of MEC. If MEC is non-hazardous, it will be removed to a secured collection point for later sale to a qualified recycler. If MEC is hazardous, it will be blown in place. Non-UXO qualified personnel may not enter the area until all known MEC has been removed or destroyed. If non-UXO qualified personnel need to enter the site, they must first be briefed on the potential hazards of the site. They must be accompanied at all times by a UXO-qualified employee of USAE. If MEC is discovered during the course of their visit, they must immediately leave the site until it can be rendered safe for re-entry.

12.2.15 SAFE DISTANCES AND PLACES OF REFUGE

The EZ of this project is the actual project footprint and an additional 235 feet around it for separation distance. Outside of that distance is the support zone. Normally, during an evacuation, personnel would evacuate to the support zone, where the UXOSO would take role and account for all site personnel. An exception to this rule would be in the case of encountering a CWM item, in which case personnel would evacuate at least 450 feet upwind of the item. This location would change with the shifting winds, so it cannot be specifically identified.

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12.2.16 POSTING OF EMERGENCY TELEPHONE NUMBERS

Emergency resources are listed in Table 12-1.

Table 12-1: Emergency Contact Numbers

Contact	Phone Number
Ambulance	911
Fire Department (Civilian)	911
Police	911
EOD Marine Corps Base Hawaii	(808) 257-7112
NAVFAC Pacific COTR, Steve Oshiro	(808) 472-1440
NAVFAC Pacific RPM, Cowan Azuma	(808) 472-1421
Hospital – Castle Medical Center, 640 Ulukahiki Street, Kailua, HI	(808) 263-5164
Poison Control Hotline	1-800-222-1222
USEPA National Response Center	1-800-424-8802
CHEMTREC	1-800-424-9300
Federal OSHA Emergency Hotline	1-800-321-OSHA (6742)
TEU (duty hours)	410-671-3601
TEU (after duty hours)	410-671-2773
USAE Program Manager, George Spencer	813-343-6358
USAE Program Safety and Health Manager, Robert Crownover	813-343-6364
USAE Program Occupational Safety Manager, Cheryl M. Riordan	757-486-8567

12.2.17 WILD LAND FIRE PREVENTION PLAN

In order to prevent grass fires from starting in the area, USAE will control employee smoking. Smoking will be permitted only in designated areas. These areas will be equipped with a fire extinguisher, as well as a can containing sand, where cigarette butts can be safety discarded without concern for the spread of fire. All lighters and matches will remain in the designated smoking area and will not be permitted into the site. All flammable liquids brought to the site for the purpose of fueling equipment, will be stored in an approved flammable liquid container in a designated flammable liquid storage area. No smoking will be permitted within 50 feet of the storage or use of flammable materials.

In the event that a grass fire does start in the area, all personnel will be trained in the use of fire extinguishers, and fire extinguishers will be available to all site operations. Fire extinguishers are designed for the incipient stages of a fire, which is when they are most effective. If a large fire starts, employees will be instructed to evacuate the area to at least fragmentation distance from the site and to contact the Marine Corps Base Hawaii Fire Department via telephone at 911. The Fire Department will remain at least fragmentation distance from the fire and implement applicable procedures to prevent the fire from spreading outside of the fragmentation distance.

12.2.18 MAN OVERBOARD/ABANDON SHIP PLAN

Due to the fact that water operations are not expected to occur on this site, no Man Overboard/Abandon Ship Plan is required.

12.3 HAZARD COMMUNICATION PROGRAM

The program establishes procedures for USAE employees who handle and store chemical products at USAE sites. It ensures that hazards of all chemicals purchased are evaluated and the information concerning their hazards is transmitted to employees. The delivery of information is to be accomplished by employee training, container labeling, and other forms of warning and MSDS. All MSDS are requested from the suppliers at the time of order. If not available then a recent MSDS will be downloaded off the Internet.

- As part of the USAE Hazard Communication Program, an MSDS binder will be maintained onsite, which includes copies of MSDSs for all hazardous materials brought onto the site by USAE. It will be kept in the UXOSO site vehicle during operations, and all USAE personnel will be made aware of that fact. This MSDS binder will be available on request to all site personnel during all working hours of the site. If site workers have further questions about any of the hazardous materials they come into contact with, the USAE PSHM will locate the required information and pass it on to the employee.
- All USAE employees who will be performing work involving the handling of hazardous materials will receive Hazard Communication training detailing the hazards of the product, appropriate protective measures to prevent exposure to the product, as well as safe procedures for storage and handling of the product, and response to emergencies. Personnel may request an MSDS for any hazardous material on the site at any time. This training will occur as part of the initial mobilization training at the site and will be documented on the USAE Documentation of Training Form.

The UXOSO must ensure that project personnel can immediately obtain the required information about chemicals of concern during an emergency.

12.4 RESPIRATORY PROTECTION PLAN

Due to the type of work taking place, respirators are not expected to be required on this site. Should unforeseen hazards develop, which would require a respirator, the USAE Respiratory Protection Program would be followed per the USAE Corporate Safety and Health Program.

12.5 HEALTH HAZARD CONTROL PROGRAM

Due to the type of work that will be taking place on this project site, toxic environments are not anticipated; therefore, the Health Hazard Control Program is not required. However, if toxic material or chemical agents are encountered, an AHA will be conducted and a Health Hazard Control Program will be implemented.

12.6 LEAD ABATEMENT PLAN

As lead is not expected to be a contaminant on this site, a Lead Abatement Plan will not be required. However, if lead should be encountered, a Lead Abatement Plan would be prepared in accordance with the requirements of the USAE Corporate Safety and Health Program.

12.7 ASBESTOS ABATEMENT PLAN

As asbestos is not expected to be encountered on this outdoor site, an Asbestos Abatement Plan is not required.

12.8 ABRASIVE BLASTING

Abrasive blasting is not required on this project.

12.9 CONFINED SPACE

Work in confined spaces is not expected to occur on this project.

12.10 HAZARDOUS ENERGY CONTROL PLAN

The work on this project should not require the use of equipment that would require a Hazardous Energy Control Plan. Should a change in the scope of work require it, the USAE Lock Out/Tag Out program would be implemented per the Corporate Safety and Health Safety Program.

12.11 CRITICAL LIFT PROCEDURES

USAE will not be performing any crane operations on this project, so critical lift procedures will not be required.

12.12 CONTINGENCY PLAN FOR SEVERE WEATHER

Rain and severe wind conditions can constitute a safety hazard to field operations at this site. The UXOSO will monitor the weather closely. If the area becomes wet, muddy, slippery, or windy such that an unacceptable level of risk exists for personnel who are working in proximity to MEC items, then MEC operations will cease until the UXOSO determines it to be safe to continue.

No MEC operations will take place if an electrical storm is within 10 miles of the site. An electrical storm monitor will be used to determine if an electrical storm is approaching. MEC operations will cease when an electrical storm is within 10 miles of the site, and will not resume again until the UXOSO determines that the electrical storm is at least 10 miles past the site.

Daily weather conditions will be a part of the daily briefing. Many people incur injuries or are killed due to misinformation and inappropriate behavior during severe weather. During severe weather, project personnel will seek shelter in an appropriate location (i.e., building or vehicle).

The individual is ultimately responsible for his/her personal safety and has the right to take appropriate action when threatened by severe weather.

12.12.1 SAFE LOCATIONS DURING SEVERE WEATHER AND LOCATIONS TO AVOID

No place is absolutely safe from severe weather; however, some places are safer than others.

- Large enclosed structures (substantially constructed buildings) tend to be much safer than smaller or open structures.
- The risk for lightning injury depends on whether the structure incorporates lightning protection, construction materials used, and the size of the structure.
- In general, fully enclosed metal vehicles such as cars, trucks, buses, or vans with the windows rolled up, provide good shelter from many weather conditions.

AVOID being in or near:

- High places and open fields, light poles, metal fences, water (lakes, streams, rivers, or wet surfaces).

When inside a building AVOID:

- Use of the telephone, washing your hands, or any contact with conductive surfaces with exposure to the outside such as metal door or window frames, electrical wiring, telephone wiring, cable TV wiring, or plumbing if lightning is a factor.

12.12.2 SAFETY GUIDELINES FOR INDIVIDUALS

Generally speaking, identify and seek shelter that is appropriate for the type of severe weather you are encountering. Proper shelter will always include a sound structure and removes you from the elements.

When available, pay attention to weather warning devices such as National Oceanic and Atmospheric Administration weather radio and/or credible weather detection systems. However, do not let this information override good common sense.

12.13 ACCESS AND HAUL ROAD PLAN

There are no plans to create access and haul roads for this project, so the Access and Haul Road Plan is not required. The only access road to the site will be controlled by USAE for the duration of site operations as a means of site control. This is further detailed in the Site Control Plan.

12.14 DEMOLITION PLAN (ENGINEERING AND ASBESTOS SURVEYS)

As work on this plan does not involve demolition of buildings containing asbestos containing material, the Demolition Plan is not required.

12.15 EMERGENCY RESCUE (TUNNELING)

As work on this project does not involve tunneling operations, this Emergency Rescue plan is not required.

12.16 UNDERGROUND CONSTRUCTION FIRE PREVENTION AND PROTECTION PLAN

As underground construction is not required on this project, the Underground Construction Fire Prevention and Protection Plan is not required.

12.17 COMPRESSED AIR PLAN

As there are no plans to use compressed air on this project, a Compressed Air Plan is not required.

12.18 FORMWORK AND SHORING ERECTION AND REMOVAL PLANS

As this project will not involve formwork and shoring erection and removal, this plan will not be required.

12.19 JACKING PLAN (LIFT) SLAB PLANS

As there will be no Lift Slab work on this project, this plan will not be required.

12.20 BLASTING PLAN

A blasting plan will not be required. Explosives will be used for MEC disposal operations in accordance with established SOP.

12.21 PLAN FOR PREVENTION OF ALCOHOL AND DRUG ABUSE

The USAE program is included as Attachment 4. All project personnel will be asked to read and abide by this plan. The policy will be posted at the job site.

12.22 FALL PROTECTION PLAN

As work will be occurring at ground level and below, a Fall Protection Plan should not be required.

12.23 STEEL ERECTION PLAN

As no steel erection will be taking place on this project, this plan is not required.

12.24 NIGHT OPERATIONS LIGHTING PLAN

As there are no plans to operate during hours of darkness, there is no requirement for a Night Operations Lighting Plan.

12.25 SITE SANITATION PLAN

Adequate sanitation facilities will be provided at each work site to ensure proper personal hygiene. Site sanitation will be established and maintained in accordance with OSHA 29 CFR 1910.120(n).

An adequate supply of potable (drinkable) water shall be provided on site at all times, and will be supplied in accordance with the following provisions.

- Containers used for potable water shall be capable of being tightly closed, equipped with a tap and maintained in a clean and sanitary condition.
- A container used for distribution of drinking water shall be clearly labeled as to its contents and not used for any other purpose.
- Water shall not be dipped from the container and use of a common cup will not be allowed.
- Where single-service cups are provided, separate sanitary containers will be provided for the storage of the unused cups and for the disposal of the used cups.
- Water coolers of drinking water will be placed in the support zone.
- Personnel will be instructed to wash their face and hands prior to drinking.
- Outlets and storage containers for non-potable water, such as water for fire fighting or decontamination will be clearly labeled to indicate that the water is not suitable for drinking with the following: "CAUTION – WATER UNSAFE FOR DRINKING, WASHING, OR COOKING." There shall at no time be a cross connection or open potential between a system furnishing potable water and a system furnishing non-potable water.
- Chemical toilets will be available at the work site. The toilet will be equipped with toilet paper, toilet paper holder, light, washing facilities, locking door, and adequate ventilation.
- Hand and face washing facilities will be set up in the support zone of the work area. These will be utilized by all personnel exiting the EZ prior to eating, drinking, tobacco use or other hand to face activities. Washing facilities will consist of potable running water, soap and drying towels. Portable eyewash will be available in site vehicles and with the EMT.

- Waste Disposal: A trash receptacle will be present in the support zone for the disposal of hand drying materials, any disposable PPE, paper towels used to dry hands and other generated site debris.
- Where eyewashes are required by OSHA due to specific eye hazards, they will be in compliance with ANSI STD.Z-358.1-2004 or later. Where not specifically required by OSHA, eyewash bottles will be maintained with the first aid kit in the site vehicles.

12.26 FIRE PREVENTION PLAN

In order to prevent fire from occurring, every step will be taken to keep the site neat and clean. All equipment and materials not in use will be put away in designated locations. There will be trash cans with lids at the site, which will be emptied on a daily basis to keep trash from accumulating. All flammable liquids will be stored in approved flammable liquid cans in order to prevent spillage and ignition of the material. Bonding and grounding procedures will be in place when transferring flammable liquids from their designated containers and into equipment. Equipment will never be fueled in the back of a pick-up truck containing a bed liner. Personnel handling explosive and/or flammable materials will wear cotton under and outer garments to prevent build-up and transfer of static electricity.

12.26.1 FIRE PROTECTION

Portable fire extinguishers are rated and classified with NUMERAL and LETTER designations, based on fire tests conducted by the Underwriters Laboratories, Inc. or other nationally recognized testing laboratories. The numeral rating indicates the relative extinguishing effectiveness of extinguishers classified for Class A and B fires only. The Letter classified coincides with the Class of Fire. Extinguishers found to be effective on more than one Class of fire have multiple Letter classifications (Example: B:C).

The rating of hand-portable fire extinguishers is based on the following:

- Class A fire extinguisher is used for ordinary combustible materials
- Class B fire extinguisher is for flammable liquids
- Class C fire extinguisher is for electrical fires
- Class D fire extinguisher is for combustible metal fires

Many fires are small at origin and may be extinguished by the use of proper hand-portable fire extinguishers. It is strongly recommended that the fire department be notified as soon as a fire is discovered. This alarm should not be delayed awaiting result of application of portable fire extinguishers.

Fire extinguishers can represent an important segment of any overall fire protection program. However, their successful functioning depends upon meeting the following conditions:

- The extinguisher is properly located and in working order
- The extinguisher is of proper type for a fire, which may occur
- The fire is discovered while still small enough for the extinguisher to be effective
- The fire is discovered by a person ready, willing, and able to use the extinguisher

Class A fires can be readily extinguished by quenching-cooling with water or a water-mixture agent. Class B fires are more effectively extinguished by an agent that blankets-smothers the fire through exclusion of oxygen surrounding the fire area. Those extinguishers containing bromochlorodifluoromethane, monobromotrifluoromethane, carbon dioxide, or dry chemical are generally best suited for extinguishing Class B fires. For Class C fires, the primary consideration in extinguishing this type of fire is the selection of nonconductive extinguishing agent to prevent dangerous electrical shock and possible death to user.

Water or water-mixture type extinguishing agent must not be used under any circumstances on energized electrical equipment (Class C) fires. When possible, electrical equipment and circuits should be de-energized before attacking a Class C fire. Due to its corrosive nature, dry chemical is not recommended for use on computerized, electronic, or other equipment with extensive circuitry.

13.0 CONTRACTOR INFORMATION

USAE is the prime contractor on this project. This APP and attached SHSP is based on USAE procedures. The project subcontractors, CH2MHILL, Wil Chee Planning and Environmental, Inc., and Donaldson Enterprises, Inc., will be required to comply with all site requirements and will attend the initial mobilization training, which will describe the work to be performed, and all safety and health requirements regarding that work. They will also be required to attend the daily tailgate safety briefings, which will go over the operations expected to take place that day. Subcontractors will also attend any special safety meetings that are taking place for the duration of their operations on the site.

14.0 SITE-SPECIFIC HAZARDS AND CONTROLS

Site-specific hazards and controls are detailed in the Activity Hazard Analyses for each activity of the operation. These can be found in Attachment 2. The specific activities on this site are as follows:

- Geophysical Prove–Out Test Strip
- Location Surveying and Mapping
- Surface Clearance
- Intrusive Survey
- MEC/MPPEH Disposal Operations
- Inspection and Certification of Munitions Debris
- Quality Control
- Vegetation Removal
- Soil Sampling

14.1 SAFETY HAZARDS

Due to the nature of planned site operations, the potential risk for exposure to safety hazards is high. Anticipated safety hazards, which may be encountered during site activities, and precautions to be followed are listed below and in individual Activity Hazard Analyses.

14.1.1 SLIPS, TRIPS, AND FALL HAZARDS

This project covers the Waikane Valley Training Area within the Marine Corps Base Hawaii. This area has greatly differing elevations due to the volcanic surface, creating steep hillsides, some of which are heavily covered in vegetation. This type of uneven surface creates a slip, trip and fall hazard for personnel walking in the area. Site personnel shall be instructed to make themselves aware of foot placement at all times to avoid slips, trips, and falls. The use of sturdy leather work boots with ankle support and non-slip soles will reduce the risk of slips, trips, and falls.

14.1.2 CUTS/LACERATION HAZARDS

There are plenty of opportunities for cuts and lacerations from working around heavy vegetation, as well as in vegetation clearance operations. Personnel will be instructed to wear leather work gloves during site operations involving vegetation removal and heavy vegetation areas to prevent injury to hands.

14.1.3 HAND TOOL OPERATION

Use of improper or defective tools can contribute significantly to the occurrence of accidents on site. Therefore, the safe work practices listed below shall be observed when using hand tools:

- Hand tools will be inspected for defects prior to each use.
- Defective hand tools will be removed from service and repaired or 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 whenever they increase gripping ability or if cut, laceration, or puncture hazards may exist during the use of hand tools.
- Safety glasses with side shields, goggles, or a face shield will be used if tool use presents an eye/face hazard.
- Do not use makeshift tools or other improper tools.
- Use non-sparking tools where there are explosive vapors, gases, or residue.

14.1.4 MATERIAL LIFTING

Many types of objects are handled in normal day to day operations. Care shall be taken in lifting and handling heavy or bulky items because they are the cause of many joint and back injuries. The following fundamentals address the proper lifting of materials to avoid joint and back injuries:

- The size, shape and weight of the object to be lifted must be considered. Site personnel will not lift more than they can handle comfortably.
- 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 shall be inspected for metal slivers, jagged edges, burrs, rough or slippery surfaces, and pinch points, and gloves shall be used, if necessary, to protect the hands.
- The feet shall be placed far enough apart for good balance and stability.
- Personnel will ensure that solid footing is available prior to lifting the object.
- When lifting, get as close to the load as possible, bend the legs at the knees, making sure that the back is kept as straight as possible.
- To lift the object, the legs are straightened from their bending position.
- Never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting, with the back kept straight, the legs bent at the knees and the object lowered.
- If the item to be lifted is too large, bulky, or heavy for one person to safely lift, ask a co-worker for assistance. If a piece of material handling equipment is available that can do the job, use the equipment instead of trying to lift it yourself.
- 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.

14.2 MUNITIONS AND EXPLOSIVES OF CONCERN

MEC may be present and located during site activities. UXO qualified personnel will follow the requirements of the USAE Safety Program, and the Basic Safety Concepts and Considerations for Ordnance and Explosives Operations, which outline the safety and health precautions to be taken if MEC are encountered and/or destroyed. All non-UXO qualified personnel will follow the safe work practices listed below:

- Non-UXO qualified personnel will receive site-specific MEC recognition training prior to participation in site activities.
- No soil penetrating activities will be allowed without the area first being cleared by UXO qualified personnel.
- Non-UXO qualified personnel will be escorted on site by UXO qualified personnel, until such time as the area is cleared.
- Once an area has been cleared and flagged, non-UXO qualified personnel may perform duties in the area unescorted, but shall not leave the cleared area unescorted.
- Non-UXO qualified personnel will not touch or disturb any object which could potentially be MEC related, and will immediately notify the nearest UXO qualified person of the presence of the object.
- In order to protect other personnel and the general public, an EZ will be set up at a distance of 235 feet all around the project footprint area of the project where work is occurring. This represents the Hazardous Fragment Distance of a 3.5-inch rocket. USAE will have control of the entrance to the project area until the area has been cleared. Should personnel not associated with the project operations need to enter the EZ, it will be coordinated with the SUXOS and they will be escorted at all times. All MEC operations will halt for the duration of time the person is within the EZ. Once they have departed the area, MEC operations may resume.

14.3 CHEMICAL HAZARDS

The only anticipated chemical hazards, which would be expected during site activities, are those fuels and oils brought on site for equipment use and maintenance. All site personnel will follow the procedures and precautions outlined in the appropriate MSDS. The MSDS binder will be kept in the SUXOS site vehicle and will be available to all employees on request. Chemical Warfare Materiel (CWM) is not expected to be found on this site.

14.4 PHYSICAL HAZARDS

For the planned site activities to be conducted, the potential for exposure to physical hazards is high for this project. The physical hazards that may be encountered during site operations and precautions to be taken are listed below.

14.4.1 FLAMMABLE/EXPLOSIVE HAZARDS FROM FUELING EQUIPMENT AND SITE VEHICLES

The chance of fire and/or explosion during vehicle and equipment refueling and maintenance is high when improper procedures are used. All site vehicles will be equipped with a portable fire extinguisher readily available to fight a fire. Equipment will never be refueled on the back of a pick-up truck with a bed liner. Cellular phones will not be used around Flammable Liquids in accordance with Ordnance and Explosives Safety Group Safety Advisory 03-2003. Grounding and bonding procedures will be used during all fueling operations. No smoking will be permitted in the vicinity (within 50 feet) of fueling operations, and flammable and combustible materials will be removed from the vicinity of fueling operations.

14.4.2 NOISE HAZARDS

Protection against the effects of noise exposure shall be provided when the sound levels exceed those shown in Table 14-1, as measured on the A scale of a standard sound level meter at slow response. When employees are subjected to sound exceeding those listed in Table 14-1, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound to a safe level, personal protective equipment shall be provided and used to reduce sound exceeding protective levels. If the variations in noise level involve maximal intervals of 1 second or less, it is to be considered continuous.

Table 14-1: Permissible Noise Exposures

Duration per Day (Hours)	Sound Level dBA (Slow Response)
8.00	90
6.00	92
4.00	95
3.00	97
2.00	**100**
1.50	102
1.00	105
0.50	110
0.25	115
Footnote (1). When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered, rather than the individual effect of each. If the sum of the following fractions: C1./T1. + C2./T2. C(n)/T(n) exceeds unity, then, the mixed exposure should be considered to exceed the limit value. C(n) indicates the total time of exposure at a specified noise level, and T(n) indicates the total time of exposure permitted at that level. Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level	

USAE shall make hearing protection available to all employees exposed to an 8-hour time-weighted average of 85 decibels or greater. Hearing protection shall be replaced as necessary. Hearing protection will be required for all personnel working in and around any operations likely to produce high noise levels, such as during the use of chain saws and weed-eaters used for vegetation clearance operations.

14.5 HEAT STRESS

Heat stress is one of the most common (and potentially serious) illnesses that affect hazardous waste site workers. When site personnel are engaged in operations involving hot environments and/or the use of semi- or impermeable clothing, a number of physiological responses can occur which may seriously affect the health and safety of the workers. These effects can be eliminated or controlled through the use of a comprehensive heat stress prevention and monitoring program. Therefore, it is the objective of this program to outline the methods and procedures by USAE personnel for the prevention, control and/or treatment of heat related illnesses.

14.5.1 CAUSES OF HEAT STRESS

The most common cause of heat stress during site activities is the effect that PPE has on the body's natural cooling mechanism. Impermeable PPE interferes with the evaporation of perspiration and causes the body to retain metabolic and environmentally induced heat. Individuals will vary in their susceptibility and degree of response to the stress induced by increased body heat. Heat stress can result in health effects ranging from transient heat fatigue to serious illness or death. Heat stress is caused 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 hazardous waste sites, regular monitoring and other preventive precautions are vital.

Factors which may predispose a worker to heat stress include:

- Lack of physical fitness
- Lack of acclimatization to hot environments
- Degree of hydration
- Level of obesity
- Current health status (e.g., having an infection, chronic disease, diarrhea, etc.)
- Alcohol or drug use
- The worker's age and sex
- Sunburn.

Reduced work tolerance and the increased risk of excessive heat stress are directly influenced by the amount and type of PPE worn. 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.

Prior to initiating site activities each day, and periodically throughout the day, the UXOSO will inspect the site personnel for evidence of the previously mentioned factors to determine those personnel who are at increased risk for heat stress related disorders. 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 throughout the day.

14.5.2 HEAT STRESS DISORDERS

This section outlines the major heat-related illnesses that may result from exposure to high heat environments and/or the use of semi-impermeable or impermeable clothing. 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.

14.5.2.1 Heat Rash

Heat rash is caused by continuous exposure to heat and humid air and is aggravated by wet, chafing clothes. This condition can decrease a worker's ability to tolerate hot environments.

Symptoms: Mild red rash, especially in areas of the body that sweat heavily.

Treatment: Decrease amount of time in protective gear and provide powder such as corn starch or baby powder to help absorb moisture and decrease chafing. Maintain good personal hygiene standards and change into dry clothes if needed.

14.5.2.2 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 patient drink one to two cups of liquids immediately, and every twenty minutes thereafter. Consult with physician if condition does not improve. If available, an electrolyte replacement solution should be taken along with liquids.

14.5.2.3 Heat Exhaustion

Heat exhaustion 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: Use passive and active cooling. Orally administer cool water and/or electrolyte replacement liquids immediately, to hydrate the victim, starting with small sips and continuing with larger amounts as the victim is able to hold it down. Total liquid consumption should be about 1 to 2 gallons per day. Transfer to a medical facility if symptoms do not subside, or become more severe.

14.5.2.4 Heat Stroke

Heat stroke is an acute and dangerous reaction to heat stress caused by a failure of the heat regulating mechanisms of the body. The failure of the individual's temperature control system causes the perspiration system to stop working correctly. When this occurs, the body core temperature rises very rapidly to a point (105+°F) where brain damage and death will result if the person is not cooled quickly.

Symptoms: The victim's skin is hot and may or may not be red and dry (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 temperatures; 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; lie down and keep the head elevated. Passive and active cooling should be used. If conscious, orally administer cool water and/or electrolyte replacement liquids immediately to hydrate the victim, starting with small sips and increasing amounts as the victim is able to hold it down. Rapidly transfer the victim to an emergency medical facility for immersion in cool water. Do not give the victim caffeinated or alcoholic beverages. Heat stroke is considered a medical emergency.

14.5.3 Preventive Measures

14.5.2.5 Required 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. These preventive measures represent the minimal steps to be taken and will include the following procedures:

The UXOSO will examine each site worker prior to start of daily operations to determine the individuals susceptible to heat induced stress. Workers exhibiting factors that make them susceptible to heat stress will be closely monitored by the UXOSO.

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 Program.

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 4- to 12-ounce cups and liquids will be provided on site. Acceptable liquids will include water and an electrolyte replacement solution. It is recommended that the water to balanced electrolyte liquids be taken at a 2:1 ratio with the intake of water being twice the intake of the balanced electrolyte liquids. Liquids containing caffeine are to be avoided.

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 ingested to replace lost sweat. When heavy sweating occurs, workers should be encouraged to drink even though they may not be thirsty. The following strategies may useful in encouraging fluid intake:

- Maintain water temperature at 50 °F to 60 °F (10 °C to 15.6 °C)
- Provide small disposable cups that hold about 4 ounces (0.1 liter)
- Have workers drink 16 ounces (0.5 liters) of fluids (preferably water or dilute drinks) before beginning work
- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight
- A shelter or shaded area will be provided where workers may be protected from direct sunlight during rest periods.

Monitoring of ambient or physiological heat stress indices will be conducted to allow prevention and/or early detection of heat induced stress. Monitoring will be conducted in accordance with applicable paragraphs of this Program.

Site workers will be given time to acclimatize to site work conditions, temperature, protective clothing, and workload. Acclimatization usually takes about a week to 10 days of continued work in hot environments, and allows the worker's body to become adjusted to this level and type of work. This process involves a gradual increase in the workload over the required period, the length of which depends upon the nature of the work performed, the ambient temperatures, the level of PPE required for the job, and the individual's susceptibility to heat stress.

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 overstress or overexertion at one task
- Add additional personnel to work teams
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.

14.5.2.6 Supplemental Preventive Measures

When possible and/or feasible, the following measures will also be implemented to aid in prevention or reduction of the effects of heat induced stress:

- Designated rest areas should be air-conditioned and the temperature maintained between 72 °F and 76 °F.
- Cooling devices will be provided to aid in body heat exchange. Cooling devices may include cooling jackets, vests or suits and field showers or hose-down areas. Depending on the severity of the heat exposure some form of artificial cooling may be required to ensure protection of the workers.
- Workers will be encouraged to achieve and maintain an optimum level of physical fitness. Increased physical fitness will allow workers to better tolerate and respond to hot environments and heavy workloads. In comparison to an unfit person, a fit person will have: less physiological strain; a lower heart rate and body temperature; and a more efficient sweating mechanism.

14.5.3 HEAT STRESS MONITORING

Because the incidence of heat stress depends on a variety of factors, all workers, even those not wearing protective equipment, should be monitored. Initially, the frequency of physiological monitoring depends on the air temperature adjusted for solar radiation and the level of physical work (see Table 14-2). The length of the work cycle will be governed by the frequency of the required physiological monitoring.

For workers wearing permeable clothing (e.g., standard cotton or synthetic work clothes), follow recommendations for monitoring requirements and suggested work/rest schedules in the current American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values for Heat Stress. If the actual clothing worn differs from the ACGIH standard ensemble in insulation value and/or wind and vapor permeability, change the monitoring requirements and work/rest schedules accordingly.

When site personnel are engaged in site activities involving the use of semi-permeable or impermeable clothing in ambient temperatures greater than 70°F, physiological monitoring will be conducted. The goal of all heat stress monitoring is to ensure that the worker's body temperature does not exceed 100.4°F. The physiological monitoring methods listed below are to be implemented based upon the severity of the heat and workload. As a minimum, the UXOSO will monitor the worker's heart rate as an indication of potential heat stress. However, if monitoring with the heart rate method indicates the need for closer, more direct monitoring, the oral temperature method will be implemented. The need for monitoring body water loss will be determined by the UXOSO, and will be based upon observation of the sweat loss experienced by site personnel during their work cycle. The frequency of physiological monitoring will be determined using the information presented in Table 14-2.

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Table 14-2: Suggested Frequency of Physiological Monitoring for Fit and Acclimatized Workers[a]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90 °F (32.2 °C) or above	After each 45 minutes of work	After each 15 minutes of work
87.5 - 90 °F (30.8 - 32.2 °C)	After each 60 minutes of work	After each 30 minutes of work
82.5 - 87.5 °F (28.1 - 30.8 °C)	After each 90 minutes of work	After each 60 minutes of work
77.5 - 82.5 °F (25.3 - 28.1 °C)	After each 120 minutes of work	After each 90 minutes of work
72.5 - 77.5 °F (22.5 - 25.3 °C)	After each 150 minutes of work	After each 120 minutes of work

[a] For work levels of 250 kilocalories/hour.

[b] Calculate the adjusted air temperature (at adj) by using this equation: at adj °F = ta °F + (13 x % sunshine). Measure air temperature (at) 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.)

[c] A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

For monitoring the body's recuperative ability toward excess heat, both of the following techniques should be used as a screening mechanism unless the UXOSO modifies the procedures and documents the log. Monitoring of personnel wearing impervious clothing should commence when the ambient temperature is 70 °F or above. As work on this site does not involve impervious clothing, monitoring for heat stress will start when the temperature reaches 75 °F. Frequency of monitoring should increase as the ambient temperature increases or as slow recovery rates to baseline (pre-work) levels are indicated.

14.5.3.1 Heart Rate Monitoring

The worker's baseline heart rate should be recorded prior to initiation of site activities by measuring the radial pulse rate for thirty seconds. After each work cycle, the heart rate should be measured by taking the pulse rate (PR) for 30 seconds and multiplying that number by 2 as early as possible into the resting period. Taking the radial (wrist) pulse rate is the preferred method; however, the carotid (neck) pulse rate may be taken if a worker has difficulty finding the radial pulse. The PR at the beginning of the rest period should not exceed 110 beats per minute (bpm). If the PR is higher than 110 bpm, the next work period should be shortened by 33%, while the length of the rest period stays the same. If the PR exceeds 110 bpm at the beginning of the next rest period, the work cycle should be further shortened by 33%. This procedure will be continued until the worker's PR at the beginning of the rest cycle is maintained below 110 bpm.

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14.5.3.2 Oral Temperature Monitoring

If deemed necessary by the UXOSO, and the conditions warrant, oral temperature (OT) monitoring will be conducted. The worker's OT will be taken and recorded prior to initiation of site activities using a clinical thermometer placed under the tongue. The OT must be taken prior to consumption of cool liquids and will be done at the end of each work period or at a frequency determined by Table 14-3. Whenever the OT exceeds 99.6 °F, the work cycle must be shortened by one third, without changing the length of the rest period. If a worker's OT has exceeded 99.6 °F, test the OT again at the end of the rest cycle, and do not allow the worker to return to work until the OT drops below 99.6 °F. If a worker's OT exceeds 100.4 °F the worker will not be allowed to work in impermeable or semi-permeable PPE for the remainder of that workday.

Table 14-3: Permissible WBGT Heat Exposure Threshold Limit Values

		Work Load	
Work - Rest Regimen	**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 work loads.

14.5.3.3 Body Weight Loss

If expected site conditions and work requirements have the potential for causing excessive fluid loss, the UXOSO will monitor the workers' fluid loss by weighing each worker prior to and again at the conclusion of each day's site activities. This will be needed to ensure that proper hydration is being maintained and that the total amount of water weight loss throughout the day does not exceed 1.5% of the employee's body weight. Body weights will be taken with the workers wearing undergarments only. If, as determined by the UXOSO, site conditions and work requirements cause an extreme amount of fluid loss, body weights will also be taken prior to the lunch break. Calculation of the water weight loss, and assessing the effectiveness of hydration shall be conducted as follows:

Once the ending weight is obtained subtract it (W_{end}) from the daily starting weight (W_{start}) to obtain the weight lost (W_{lost}) during a given work period, i.e.,: (W_{start}) - (W_{end}) = (W_{lost}).

Multiply the starting weight by 1.5% to obtain permissible weight loss (W_{perm}), i.e.,:

(W_{start}) x 0.015 = (W_{perm}).

Compare (W_{lost}) to the (W_{perm}), if (W_{lost}) is less than or equal to (W_{perm}), then hydration during the measured period has been adequate, but if (W_{lost}) is greater than (W_{perm}), then hydration should be increased during the next work period.

14.5.3.4 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 effects. The UXOSO will use a real-time direct reading WBGT monitor, and after estimating the work load, use the values expressed in Table 14-3, to determine the work/rest schedule to be implemented. The values outlined in this table are designed such that nearly all acclimatized, fully clothed workers with adequate salt and water intake will be able to function without the body temperature exceeding 100.4 °F. If conditions and/or work loads warrant, the UXOSO may also implement the OT and water weight loss monitoring.

Acclimatization is the adaptive process that results in a decrease of the physiological response produced by the application of a constant environmental stress. On initial exposure to a hot environment, there is an impaired ability to work and evidence of physiological strain. If the exposure is repeated on several successive days, there is a gradual return of the ability to work and a decrease in physiological strain. Within 4 to 7 days following initiation of the acclimatization process, a dramatic improvement in the ability to perform work is noticed: subjective discomfort practically disappears; body temperature and heart rate are lower; there is a more stable blood pressure; and the sweat is more profuse and dilute.

Alcohol should not be consumed in a hot environment because the loss of body fluids increases the risk of heat stress.

14.5.4 HEAT STRESS DOCUMENTATION

The UXOSO will be responsible for recording all heat stress related information. This will include training sessions, monitoring data. Training sessions will be documented using the Documentation of Training form. Pulse rate monitoring data will be recorded on the Heat Stress Monitoring Log (see Safety Forms in Attachment 7), with the WBGT, OT and/or water loss calculations being recorded in the Site Safety Log, and/or Site Monitoring Log.

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 require monitoring IAW the USAE Heat Stress Prevention Program. As workload increases, the heat stress impact on an unacclimatized worker is exacerbated. For unacclimatized workers performing a moderate level of work, the permissible heat exposure TLV should be reduced by approximately 2.5 °C.

14.6 IONIZING RADIATION HAZARDS

Ionizing radiation is not expected to be an issue on this project site.

15.0 BIOLOGICAL HAZARDS

Biological hazards, which are usually found on site, include hazardous plants, bees, spiders, and parasites. Employee awareness and the safe work practices outlined in the following paragraphs should reduce the risk associated with these hazards.

15.1 BEES, HORNETS, AND WASPS

Contact with stinging insects like bees, hornets, and wasps may result in site personnel experiencing adverse health effects that range from being mildly uncomfortable to being life threatening. Therefore, stinging insects present a serious hazard to site personnel, and extreme caution must be exercised whenever site and weather conditions increase the risk of encountering stinging insects. Some of the factors related to stinging insects that increase the degree of risk associated with accidental contact are as follows:

- The nests for these insects are frequently found in remote wooded or grassy areas.
- The nests can be situated in trees, rocks, and bushes or in the ground, and are usually difficult to see.
- Accidental contact with these insects is highly probable, especially during warm weather conditions when the insects are most active.

- If a site worker accidentally disturbs a nest, the worker may be inflicted with multiple stings, causing extreme pain and swelling which can leave the worker incapacitated and in need of medical attention.
- Some people are hypersensitive to the toxins injected by a sting, and when stung, experience a violent and immediate allergic reaction resulting in a life-threatening condition known as anaphylactic shock.
- Anaphylactic shock manifests itself very rapidly and is characterized by extreme swelling of the body, eyes, face, mouth and respiratory passages.
- The hypersensitivity needed to cause anaphylactic shock, can in some people, accumulate over time and exposure, therefore even if someone has been stung previously, and not experienced an allergic reaction, there is no guarantee that they will not have an allergic reaction if they are stung again.

With these things in mind, and with the high probability of contact with stinging insects, all site personnel will comply with the following safe work practices:

- If a worker knows that he is hypersensitive to bee, wasp, or hornet stings, he must inform the UXOSO of this condition prior to participation in site activities.
- All site personnel will be watchful for the presence of stinging insects and their nests, and will advise the UXOSO if a stinging insect nest is located or suspected in the area.
- Any nests located on site will be flagged off and site personnel will be notified of its presence.
- If stung, site personnel will immediately report to the UXOSO to obtain first aid treatment and to allow the UXOSO to observe them for signs of allergic reaction. If a breathing emergency (anaphylactic shock) occurs as a result of the sting, immediately call 911.
- Site personnel with a known hypersensitivity to stinging insects will keep required emergency medication on or near their person at all times, and will let the UXOSO and co-workers know where it is kept.

15.2 SPIDERS

A large variety of spiders may be encountered during site activities. While most spider bites merely cause localized pain, swelling, reddening and in some cases, tissue damage, there are a few spiders that, due to the severity of the physiological effects caused by their venom, are dangerous. These species include the black widow and the brown or violin spiders.

The black widow is a coal-black bulbous spider about ¾-inch in length, with a bright red hourglass on the underside of the abdomen. The black widow is usually found in dark moist locations, especially under rocks, rotting logs and may even be found in outdoor toilets where they inhabit the underside of the seat. Victims of a black widow bite may exhibit the following signs or symptoms:

- Sensation of pinprick or minor burning at the time of the bite.
- Appearance of small punctures (but sometimes none are visible).
- After 15 to 60 minutes, intense pain is felt at the site of the bite which spreads quickly, and is followed by profuse sweating, rigid abdominal muscles, muscle spasms, breathing difficulty, slurred speech, poor coordination, dilated pupils, and generalized swelling of face and extremities.

The brown or violin spider is brownish to tan in color, rather flat, about 5/8-inch long with a dark brown “violin” shape on the top. Of the brown spider, there are three varieties found in the United States, which present a problem to site personnel. These are the brown recluse, the desert violin and the Arizona violin. These spiders may be found in a variety of locations including trees, rocks or in dark locations. Victims of a brown or violin spider bite may exhibit the following signs or symptoms:

- Blistering at the site of the bite, followed by a local burning at the site 30 to 60 minutes after the bite.
- Formation of a large, red, swollen, postulating lesion with a bull's-eye appearance.
- Systemic effects may include a generalized rash, joint pain, chills, fever, nausea and vomiting.
- Pain may become severe after 8 hours, with the onset of tissue necrosis.

There is no effective first aid treatment for either of these bites. Except for very young, very old or weak victims, these spider bites are not considered to be life threatening; however, medical treatment must be sought to reduce the extent of damage caused by the injected toxins. If either of these spiders are suspected or known to be on site, the UXOSO will brief site personnel as to the identification and avoidance of the spiders. As with stinging insects, site personnel shall report to the UXOSO if they locate either of these spiders on site or notice any type of bite while involved in site activities.

15.3 PARASITES

Parasites are known to exist in fresh water lakes and streams in Hawaii. They can enter the system through drinking or swimming in the water and can cause stomach and intestinal distress. It is recommended that personnel working on this site not engage in swimming in fresh-water lakes and streams in the area. It is also recommended that personnel not drink water that has not been processed for drinking.

15.4 ANIMALS

15.4.1 FERAL DOGS

Feral dogs like other canids are most active from dusk to dawn and travel in packs. Feral dogs usually do not fear humans and may display aggressive behavior during encounters with people. Do not approach or attempt to interact with any wild animals on the project site. Do not run unless you are sure you can escape as this will trigger the dog's hunting instinct, remain facing the animals and slowly retreat. Feral dogs may carry numerous pathogens that can be transmitted to humans including, tetanus, rabies, and tapeworms. If bitten, clean the wounds and seek immediate medical treatment.

15.4.2 FERAL PIGS

Feral pigs are found throughout Hawaii to include the project site. Feral pigs normally feed in the early morning and late afternoon, but in cooler weather, may be seen feeding at any time of day. Feral pigs are not generally aggressive but may charge if cornered. Feral pigs carry infectious diseases that can be transmitted to humans, among them are rabies and swine brucellosis. Symptoms of swine brucellosis include malaise, loss of appetite, myalgia, depression and intermittent fever.

15.5 HAZARDOUS PLANTS

During the conduct of site activities the number and variety of hazardous plants that may be encountered is large and extensive. The ailments associated with these plants range from mild hay fever to contact dermatitis, to carcinogenic effects. However, the plants that present the greatest degree of risk to site personnel (i.e., potential for contact vs. effect produced) are those which produce skin and tissue injury and skin reactions.

15.5.1 PLANTS CAUSING SKIN AND TISSUE INJURY

Contact with splinters, thorns and sharp leaf edges is of special concern to site personnel, as is the contact with the pointed surfaces found on branches, limbs and small trunks left by site clearing and grubbing crews. 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 impermeable 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 immediately to the UXOSO for initial and continued observation and care of the injury.

15.5.2 PLANTS CAUSING SKIN REACTIONS

A number of plants are found in Hawaii cause skin reactions, among them are the mango tree and the elephant ear. The sap from the mango tree contains toxins related to poison ivy and poison oak. Individuals sensitive to poison ivy or poison oak may have a reaction to the mango leaves and the fruit's skin. Repeated exposures to the mango increases the reaction, so sensitive individuals should avoid contact.

The elephant ear is related to the taro plant and grows in wet, muddy conditions near streams and rivers. The plants' leaves grow to 4 feet and contain calcium oxalate crystals, tiny sharp needles inside the plant cells that irritate the skin. Crushing the leaves or stalk will cause a burning rash where the crystals embed in the skin.

The allergic reaction associated with exposure to these plants will generally cause the following signs and symptoms:

- Blistering at the site of contact, usually occurring within 12 to 48 hours after contact.
- Reddening, swelling, itching and burning at the site of contact.
- Pain, if the reaction is severe.
- Conjunctivitis, asthma, and other allergic reactions if the person is extremely sensitive to the poisonous plant toxin.

If the rash is scratched, secondary infections can occur. The rash usually disappears in 1 to 2 weeks in cases of mild exposure and up to 3 weeks when exposure is severe. Preventive measures, which can prove effective for most site personnel, are:

- Avoid contact with any poisonous plants on site, and keep a steady watch to identify, report and mark poisonous plants found on site.
- Wash hands, face or other exposed areas at the beginning of each break period and at the end of each workday.
- Avoid contact with, and wash on a daily basis, contaminated tools, equipment and clothing.
- Barrier creams, detoxification/wash solutions and orally administered desensitization may prove effective and should be tried to find the best preventive solution.
- 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.

16.0 LOGS, RECORD KEEPING, AND REPORTS

USAE will perform and document safety inspections, as well as maintain a site visitor log. Personnel records will be kept on site, which document medical surveillance and appropriate training certifications. In addition, accident reports and site monitoring reports will also be maintained on site. All site logs, documents, and records will be included in the final report.

16.1 SAFETY INSPECTION LOGS

The UXOSO will perform and document daily and weekly safety inspections of all site operations on a scheduled and non-scheduled basis. The UXOSO will conduct non-scheduled safety and health inspections as deemed appropriate, based upon the ongoing site activities. Scheduled safety and health inspections will be conducted as outlined in Table 16-1. When discrepancies are observed, follow-up will be documented in the UXOSO log until the corrective actions required have been completed.

Table 16-1: Inspection Type and Frequency

Area	Frequency
Sanitation	Daily
Medical and First Aid	Daily
Temporary Facilities	Weekly
Personal Protective and Safety Equipment	Daily
Hazardous Substances, Agents, and Environments	Weekly
Lighting	Monthly
Accident Prevention Signs, Tags, Labels, and Signals and Piping System Identification	Monthly
Fire Prevention and Protection	Weekly
Hand and Power Tools	Daily, if applicable
Material Handling, Storage and Disposal	Weekly
Machinery and Mechanized Equipment	Daily, if applicable
Motor Vehicles	Daily
Safe Access and Fall Protection	Weekly, if applicable
HTRW	Daily, if applicable

16.2 VISITOR LOG

The Visitor Log will be maintained by the UXOSO and will document the visitor's name, company name, date, time, and reason for visit. There will also be documentation that the visitor was given a safety briefing prior to being permitted to enter the EZ of the site. Visitors will be escorted by UXO personnel at all times within the EZ. MEC operations will cease while visitors are within the EZ.

16.3 RECORD KEEPING

Each person on the site will have an individual file folder, which contains a copy of the following:

- 40-hr HAZWOPER Certificate
- Current 8-hr HAZWOPER Annual Refresher Certificate
- 8-hr HAZWOPER Supervisor Certificate, if applicable

- EOD Training Certificate
- Any other applicable training certificates.

Personnel folders will be maintained by the UXOSO on site for the duration of site activities. A Training/Tailgate Safety Record will be completed for all on-site daily training. The UXOSO will maintain the file, which will be made available for the client as requested.

16.4 MEDICAL SURVEILLANCE RECORDS AND CERTIFICATIONS

A copy of the Physician Statement from a licensed physician who is certified in Occupational Medicine by the American Board of Preventive Medicine, regarding the current annual HAZWOPER physical examination, will be maintained in the personnel folder with the HAZWOPER certificates. The Physician Statements will remain in the individual's file on the project site for the duration of site operations. The files will then be transferred to the Corporate Office in Oldsmar, FL, at the end of site operations.

16.5 ACCIDENT REPORTING RECORDS

Should an accident occur on the site, all reports and records will be documented. Copies will be maintained on site for the duration of site activities. A permanent copy will be maintained in the Oldsmar, FL, office.

16.6 SITE MONITORING RESULTS

All site monitoring results will be documented. This will be kept in a file at the project site for reference, and will become a part of the permanent site record at the conclusion of site activities. At this site, heat exposure monitoring is the only monitoring anticipated which is dependent upon the site temperature and wind speed.

16.7 FINAL REPORT

USAE will develop, retain and submit as part of the final report, all visitor registration logs, training logs, and daily safety inspection logs as part of the daily QC reports.

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APPENDIX E - ATTACHMENT 1. OSHA FORM

This attachment contains a blank OSHA Form 300 for recording any reportable accidents or injuries during field activities.

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OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year ______

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an injury and illness incident report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name: USA Environmental, Inc.

City: OldsMar State: Florida

Identify the person			Describe the case			Classify the case												
						CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness: (M)						
(A) Case No.	(B) Employee's Name	(C) Job Title (e.g., Welder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Death (G)	Days away from work (H)	Remained at work: Job transfer or restriction (I)	Remained at work: Other record-able cases (J)	Away From Work (days) (K)	On job transfer or restriction (days)	Injury (1)	Skin Disorder (2)	Respiratory Condition (3)	Poisoning (4)	Hearing Loss (5)	All other illnesses (6)
1																	
2																	
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4																	
					Page totals	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
(1)	(2)	(3)	(4)	(5)	(6)

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

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APPENDIX E - ATTACHMENT 2. ACTIVITY HAZARD ANALYSES (AHAS)

This attachment contains the following Activity Hazard Analysis sheets:

- Establish Instrument Test Strip
- Location, Survey and Mapping
- MEC Surface Clearance
- MEC Investigation
- MEC MPPEH Disposal
- MD Inspection and Certification
- Quality Control Inspection
- Soil Sampling
- Vegetation Removal.

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Activity Hazard Analysis (AHA)

Instrument Test Strip

Activity: Establish Geophysical Instrument Test Strip (ITS)	**Date: June 19, 2009** **Project: RI/FS of Waikane Valley Training Area, Kaneohe, HI**
Description of the work: Emplace inert ordnance items or simulants at various depths and attitudes in the Geophysical Prove-Out Test Strip	**Prepared By: Cheryl Riordan, CSP** **Analyzed by Robert Crownover** **Review for latest use:** Each time before the job is performed.

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• Using geophysical equipment, the UXOQCS will locate a plot of land where an ITS can be prepared and assure there are no buried anomalies in the area. • Using inert ordnance or other items that would give off a similar signature, the UXOQCS will bury these items at differing depths and directions throughout the ITS. • The UXOQCS will prepare a map of the ITS showing all of the buried items. • Each day, prior to use of geophysical equipment, each person will test the equipment on the ITS. • If the geophysical equipment is able to locate all buried items in the ITS, it will be used for work that day. • If the geophysical equipment is not able to locate all buried items in the ITS, it will be removed from service until repairs can be made. Another piece of equipment will be tried until one is found that can detect all buried items in the GPO Test Strip.	• MEC hazards • Uneven working surfaces – slip, trip, fall hazards. • Muscle strain carrying instruments, using shovels. • Heat stress • Biological hazards - bees, wasps, parasites, feral dogs, feral pigs and hazardous plants. • Cuts and abrasions from handling rocks or buried debris during burial of inert ordnance. • Sunburn	• On-site MEC training. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Follow appropriate lifting/ carrying procedures. • Heat stress monitoring, drinking water, work-rest schedule, and cool shelter for breaks. • Training in biological hazards avoidance. • Use insect repellant and barrier creams. • Wear cap for head protection and use sunscreen. • PPE – leather work gloves. • Wear light weight long sleeved shirts and long pants.

Instrument Test Strip

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Appropriate geophysical equipment. • Footwear with ankle support and non-slip soles (no steel toes around magnetometers). • Shovel • Back braces (optional). • Communications equipment. • Appropriate clothing and PPE (to include leather gloves, safety glasses or goggles, reflective safety vest). • First aid kit. • Fire extinguishers. • WBGT monitor.	**Team Leader/UXOSO** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use • Communications equipment checked daily prior to use. • First aid kits checked daily and inspected weekly. • Fire extinguishers checked daily and inspected weekly.	• UXO personnel will meet training and experience requirements outlined in DDESB TP 18. • On site MEC training. • Site-specific training, slip/fall hazards. • Site-specific training/lifting techniques. • Heat Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • PPE Training. • All site personnel will have current HAZWOPER training.
HAZWOPER = Hazardous Waste Operations and Emergency Response PPE = Personal Protective Equipment UXOQCS = UXO Quality Control Specialist		

Activity Hazard Analysis (AHA)

Instrument Test Strip

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Activity Hazard Analysis (AHA)

Location, Survey and Mapping

Activity: Location, Survey and Mapping	**Date: June 19, 2009** **Project: RI/FS of Waikane Valley Training Area, Kaneohe, HI**
Description of the work: Locate Various Range Boundaries and Establish Site Grid System for Conducting Remedial Investigation.	**Prepared By: Cheryl Riordan, CSP** **Analyzed By: Robert Crownover** **Review for latest use:** Each time before the job is performed.

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• UXO personnel will accompany survey team to site. • UXO personnel will lead team into area and will clear the path of entry into the site. If MEC is encountered, path will be routed around it. • If live MEC is encountered, the area will be marked and photographed. • Where intrusive operations, such as driving stakes, are required UXO personnel, using geophysical equipment, will determine if there are potential MEC beneath the ground surface. • If potential MEC is located below the ground surface, the area for the intrusive operations will be moved. • When clear area is located, the stakes will be driven. • Location data will be prepared and submitted at completion of work.	• MEC hazards • Uneven working surfaces – slip, trip, fall hazards. • Muscle strain carrying instruments • Heat Stress • Biological hazards - bees, wasps, parasites, feral dogs, feral pigs, and hazardous plants. • Sunburn	• On-site MEC training. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Follow appropriate lifting/ carrying procedures. • Heat stress monitoring, drinking water, work-rest schedule, and cool shelter for breaks. • Training in biological hazards avoidance. • Use insect repellant and barrier creams. • Wear cap for head protection and use sunscreen. • Wear light weight long sleeved shirts and long pants.

Location, Survey and Mapping

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Appropriate geophysical equipment. • Footwear with ankle support and non-slip soles (no steel toes around magnetometers). • Back braces (optional). • Communications equipment. • Appropriate clothing and PPE to include leather gloves, safety glasses or goggles, reflective safety vest. • First aid kit. • Fire extinguishers. • WBGT monitor.	**Team Leader/UXOSO** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use • Communications equipment checked daily prior to use. • First aid kits checked daily and inspected weekly. • Fire extinguishers checked daily and inspected weekly,	• UXO personnel will meet training and experience requirements outlined in DDESB TP 18. • Site-specific MEC training will be presented to all site personnel. • Site-specific training, slip/fall hazards. • Site-specific training/lifting techniques. • Heat Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • PPE training. • Current HAZWOPER Training.
EOD = Explosive Ordnance Disposal HAZWOPER = Hazardous Waste Operations and Emergency Response MEC = Munitions and Explosives of Concern PPE = Personal Protective Equipment UXO = Unexploded Ordnance		

Activity Hazard Analysis (AHA)

Location, Survey and Mapping

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Activity Hazard Analysis (AHA)

MEC Surface Clearance

Activity: MEC Surface Clearance	**Date: June 19, 2009** **Project: RI/FS Waikane Valley Training Area, Kaneohe, HI**
Description of the work: Employ approved techniques and methods during surface clearance of MEC/UXO contamination of site.	**Prepared By: Cheryl Riordan, CSP** **Analyzed By: Robert Crownover** **Review for latest use:** Each time before the job is performed.

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• Locate anomalies using geophysical equipment as well as visual survey. • In areas where vegetation is too dense to accurately perform survey, vegetation clearance operations will be performed in accordance with established procedures. • Surface MEC will be identified using pin flags, GPS coordinates or other identification, and photographs. • UXO Technicians will perform blow in place disposal operations on all surface MEC/MPPEH encountered in accordance with established procedures.	• MEC hazards • Uneven working surfaces – slip, trip, fall hazards. • Muscle strain carrying instruments • Heat Stress • Biological hazards – bees, wasps, parasites, feral dogs, feral pigs and hazardous plants. • Unauthorized personnel entering site during operations. • Noise hazards. • Cuts/lacerations hazards • Sunburn	• On-site MEC Training. • Establish 235 foot exclusion zone around project site. • Establish 235 foot separation distance between teams. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Follow appropriate lifting/ carrying procedures • Heat stress monitoring, drinking water, work-rest schedule, and cool shelter for breaks. • Training in biological hazards avoidance; PPE • Use insect repellant and barrier creams. • Wear long sleeved shirts and long pants. • Wear cap for head protection and use sunscreen. • Site control measures will be implemented (fencing, barricades, signage) and exclusion zone established. • PPE for noise and cuts/lacerations. Tools and equipment will be used in the manner in which it was designed to be used. • Chainsaw engines will be started and stopped when all co-workers are clear of the saw. • Chainsaws will be properly supported when in use. • Operator will shut off saw when carrying it over slippery surfaces, through heavy brush, and when adjacent to personnel. • Saw can be carried with the engine idling for short

		distances (less than 50 feet) as long as it is carried to prevent contact with the chain or muffler. • Chopping tools with loose or cracked heads or splintered handles will not be used. • Chopping tools shall not be driven as wedges or used to drive metal wedges.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Appropriate geophysical equipment. • Vegetation clearance equipment. • Pin Flags. • Footwear with ankle support and non-slip soles (no steel toes around magnetometers). • Back braces (optional) • Communications equipment. • Appropriate clothing and PPE to include safety glasses or goggles, leather gloves, reflective safety vest. Hearing protection, hard hat, face shield, and leg chaps will be worn during vegetation clearance operations. • Barricades and signage. • First aid kit. • Fire extinguishers. • WBGT monitor.	**Team Leader/UXOSO** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use. • Communications equipment checked daily prior to use. • First aid kits checked daily and inspected weekly. • Fire extinguishers checked daily and inspected weekly.	• UXO personnel will meet training and experience requirements outlined in DDESB TP 18. • Site-specific MEC training will be presented to all site personnel. • Site-specific training on slip, trip and fall hazards. • Site-specific training/lifting techniques. • Heat Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • All site personnel will have current HAZWOPER training.

Activity Hazard Analysis (AHA)

MEC Surface Clearance

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Activity Hazard Analysis (AHA)

MEC Investigation

Activity: MEC Investigation	**Date: June 19, 2009** **Project: RI/FS Waikane Valley Training Area, Kaneohe, HI**
Description of the work: Employ approved techniques and methods during investigation of MEC/UXO contamination of site.	**Prepared By: Cheryl Riordan, CSP** **Analyzed By: Robert Crownover** **Review for latest use:** Each time before the job is performed.

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• Locate anomalies using geophysical equipment. • Reacquire selected anomalies from dig sheet. • Carefully dig up MEC and identify it's type and condition. • Munitions debris and scrap will be removed and placed in a secured container for storage until the end of the project, when it will be shipped to a qualified recycler. • Location of MEC/MPPEH will be identified using pin flags. • UXO Technicians will perform blow in place disposal operations on MEC/MPPEH that is encountered, in accordance with established procedures.	• MEC hazards • Uneven working surfaces – slip, trip, fall hazards. • Muscle strain carrying instruments • Heat Stress • Biological hazards – bees, wasps, parasites, feral dogs, feral pigs and hazardous plants. • Unauthorized personnel entering site during operations. • Sunburn	• On-site MEC Training. • Establish 235 foot exclusion zone around project site. • Establish 235 foot separation distance between teams. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Follow appropriate lifting/ carrying procedures • Heat stress monitoring, drinking water, work-rest schedule, and cool shelter for breaks. • Training in biological hazards avoidance; • Use insect repellant and barrier creams. • Wear long sleeved shirts and long pants. • Wear cap for head protection and use sunscreen. • Site control measures will be implemented (fencing, barricades, signage) and exclusion zone established. • PPE. • Tools and equipment will be used in the manner in which it was designed to be used.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Appropriate geophysical equipment. • Footwear with ankle support and non-slip soles (no steel toes around magnetometers). • Back braces (optional) • Communications equipment. • Appropriate clothing and PPE to include safety glasses or goggles, leather gloves, reflective safety vest. • Barricades and signage. • Pin Flags • First aid kit. • Fire extinguishers. • WBGT monitor.	**Team Leader/UXOSO** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use. • Communications equipment checked daily prior to use. • First aid kits checked daily and inspected weekly. • Fire extinguishers checked daily and inspected weekly.	• UXO personnel will meet training and experience requirements outlined in DDESB TP 18. • Site-specific MEC training will be presented to all site personnel. • Site-specific training on slip, trip and fall hazards. • Site-specific training/lifting techniques. • Heat Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • All site personnel will have current HAZWOPER training.

Activity Hazard Analysis (AHA)

MEC Investigation

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Activity Hazard Analysis (AHA)

MEC/MPPEH Disposal Operations

Activity: MEC/MPPEH Disposal Operations	**Date: June 19, 2009** **Project: RI/FS Waikane Valley Training Area, Kaneohe, HI**
Description of the work: Disposal of MEC/MPPEH Encountered, by Means of Detonation.	**Prepared By: Cheryl M. Riordan** **Analyzed By: Robert Crownover** **Review for latest use:** Each time before the job is performed.

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• All disposal will be a blow in place operation. • Evacuate project disposal area, except for personnel involved in disposal operation. • Exclusion zone may vary depending on the fragmentation distance of the item in question. Fragmentation distance will be determined prior to disposal with the concurrence of the Navy Representative. • Identify item. • Prepare shot. • Personnel performing disposal evacuate to at least fragmentation distance. • Perform disposal operation. • Check to see that disposal operation was successful. • If not successful, repeat disposal operation.	• MEC hazards • Uneven working surfaces – slip, trip, fall hazards. • Heat Stress • Biological hazards – bees, wasps, parasites, feral dogs, feral pigs and hazardous plants. • Unauthorized personnel entering site during operations. • Noise • Sunburn	• On-site MEC Training. • Establish exclusion Zone. • Controlled use of radios and cell phones. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Heat stress monitoring, drinking water, work-rest schedule, and cool shelter for breaks. • Training in biological hazards avoidance; • Use insect repellant and barrier creams. • Wear long sleeved shirts and long pants. • Wear cap for head protection and use sunscreen. • Site control measures will be implemented (fencing, barricades, signage) and exclusion zone established. • PPE.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Appropriate blasting equipment and explosives. • Leather work boots with ankle support and non-slip soles. • Communications equipment. • Appropriate clothing and PPE to include leather gloves, safety glasses or goggles, reflective safety vest and hearing protection. • First aid kit. • Fire extinguishers • WBGT Monitor.	**Team Leader/UXOSO** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use. • Communications equipment checked daily prior to use. • First aid kits checked daily and inspected weekly. • Fire extinguishers checked daily and inspected weekly,	• UXO personnel will meet training and experience requirements outlined in DDESB TP 18. • Training is use of blasting equipment. • Site-specific MEC training will be presented to all site personnel. • Site-specific training on slip, trip and fall hazards. • Heat Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • All site personnel will have current HAZWOPER training.

Activity Hazard Analysis (AHA)

MEC/MPPEH Disposal Operations

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Activity Hazard Analysis (AHA)

Inspection and Certification of Munitions Debris

Activity: MPPEH/Related Scrap Inspection, Certification and Disposal.	**Date: June 19, 2009** **Project: RI/FS Waikane Valley Training Area, Kaneohe, HI**
Description of the work: Inspect and certify MPPEH/related scrap collected on the project site.	**Prepared By: Cheryl M. Riordan, CSP** **Analyzed By: Robert Crownover** **Review for latest use:** Each time before the job is performed.

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• When MEC scrap is encountered, two UXO Technicians will verify that it is inert. • After a disposal operation, disposal team will check area of the shot for MEC scrap and two UXO technicians will verify that it is inert. • Inert scrap will be placed in a secured bin on the site until the completion of site operations. • The bin will remain secured to prevent intermingling of scrap items. • QC Specialist will inspect bin periodically to assure procedures are followed and no live MEC is intermingled • At conclusion of site operations, the MEC scrap will be certified and transferred to an approved recycler for demilitarization and recycling of the metal scrap.	• MEC hazards • Uneven working surfaces – slip, trip, fall hazards. • Heat Stress • Biological hazards – bees, wasps, parasites, feral dogs, feral pigs and hazardous plants. • Sunburn. • Cuts/lacerations.	• On-site MEC training. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Heat stress monitoring, drinking water, work-rest schedule, and cool shelter for breaks. • Training in biological hazards avoidance; • Use insect repellant and barrier cream. • PPE Leather work gloves. • Wear long sleeved shirts and long pants. • Wear cap for head protection and use sunscreen.

Inspection and Certification of Munitions Debris

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• MEC scrap bin, secured. • Leather work boots with ankle support and non-slip soles. • Communications equipment. • Appropriate clothing and PPE to include leather gloves and safety glasses or goggles, reflective safety vest. • First aid kit. • Fire extinguishers • WBGT Monitor	**Team Leader/UXOSO** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use. • Communications equipment checked daily prior to use. • First aid kits checked daily and inspected weekly. • Fire extinguishers checked daily and inspected weekly,	• UXO personnel will meet training and experience requirements outlined in DDESB TP 18. • Site-specific MEC training will be presented to all site personnel. • Site-specific training on slip, trip and fall hazards. • Heat Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • All site personnel will have current HAZWOPER training.

Activity Hazard Analysis (AHA)

Inspection and Certification of Munitions Debris

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Activity Hazard Analysis (AHA)

QC Inspection

Activity: Quality Control Inspection.	**Date: June 19, 2009**
	Project: RI/FS Waikane Valley Training Area, Kaneohe, HI
Description of the work: Inspect work performance of project personnel and task at project site.	**Prepared By: Cheryl Riordan, CSP**
	Analyzed By: Robert Crownover
	Review for latest use: Each time before the job is performed.

Task Breakdown	Identify & Analyze the Hazards	Identify Hazard Controls
• Inspection of Project Documentation, Site Conditions, Work Performance and Operations. • Inspection of Material and Packaging of Containers. • Inspection of Completed Project Documentation.	• MEC hazards • Uneven working surfaces – slip, trip, fall hazards. • Muscle strain carrying instruments • Heat Stress • Biological hazards – bees, wasps, parasites, feral dogs, feral pigs, and hazardous plants. • Unauthorized personnel entering site during operations • Cuts, lacerations, eye and face hazards due to vegetation removal operations. • Noise due to vegetation clearance operations.	• On-site MEC Training. MEC avoidance will be practiced. • Post barriers and barricades as necessary prior to commencing operations and maintain positive site control. • MEC items will not be handled if encountered. • Wear the appropriate PPE for the task being performed. • Keep personnel to a minimum during operations. • Ensure required site documentation is on hand. • Ensure logs, briefings, reports and forms are completed in a timely and accurate manner. • Use and enforce the buddy system. • Ensure 1st. Aid Kits and Fire Extinguishers are in place. • No smoking, except in designated areas. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Follow appropriate lifting/ carrying procedures • Heat stress monitoring, drinking water, work-rest schedule, and cool shelter for breaks. • Training in biological hazards avoidance; PPE. • Observe all MEC safety precautions, and follow safe work practices. • Be alert. Cease operations if unsafe conditions arise. • Identify safety/hazardous zones of operations. • Review or inspect all site generated documents for accuracy and deliverability.

		• Ensure concerned parties receive copies of documents pertaining to their activities. • Ensure contract deliverables have been met.

Equipment to be used	Inspection Requirements	Training Requirements
• Appropriate geophysical equipment. • Footwear with ankle support and non-slip soles (no steel toes around magnetometers). • Back braces (optional) • Communications equipment. • Appropriate clothing and PPE to include leather gloves, safety glasses or goggles, reflective safety vest. Hard hats, face shields, hearing protection and leg chaps for vegetation removal operations. • Barricades and signage. • First aid kit. • Fire extinguishers. • WBGT monitor.	**The UXOQCS** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use. • Communications equipment checked daily prior to use. • First aid kits checked daily and inspected weekly. • Fire extinguishers checked daily and inspected weekly.	• UXO personnel will meet training and experience requirements outlined in DDESB TP 18. • Site-specific MEC training will be presented to all site personnel. • Site-specific training on slip, trip and fall hazards. • Site-specific training/lifting techniques. • Heat Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • PPE training. • All site personnel will have current HAZWOPER training.

Activity Hazard Analysis (AHA)

QC Inspection

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Activity Hazard Analysis (AHA)

Activity: Vegetation Removal	**Date: June 19, 2009** **Project: RI/FS Waikane Valley Training Area, Kaneohe, HI**
Description of the work: Conduct a vegetation removal (as needed) to facilitate a safe and effective MEC remedial investigation.	**Prepared By: Cheryl Riordan, CSP** **Analyzed By: Robert Crownover** **Review for latest use:** Each time before the job is performed.

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• If there are areas where dense vegetation prevents a complete surface clearance and a DGM survey of subsurface MEC contamination in the area, vegetation removal will be conducted as needed. • Vegetation is extremely dense in some areas; vegetation clearing will be required using machetes as well as gasoline-powered weed eaters, chain saws, etc. • If live MEC is encountered, a blow in place disposal operation will be performed.	• MEC hazards • Uneven working surfaces – slip, trip, fall hazards. • Heat Stress • Biological hazards - bees, wasps, feral dogs, feral pigs, parasites and hazardous plants. • Muscle strain carrying equipment. • Lacerations and cuts from vegetation clearing equipment. • Eye/face injuries due to use of vegetation clearing equipment. • Noise • Sunburn	• On-site MEC training. • Maintain 235 foot team separation distance. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Heat stress monitoring, drinking water, work-rest schedule, and cool shelter for breaks. • Training in biological hazards avoidance. • Use insect repellent and barrier cream. • Follow appropriate lifting/ carrying procedures. • PPE – hard hat, face shield, safety glasses, hearing protection, leather gloves and leg chaps during vegetation clearance operations. • Wear long sleeved shirts and long pants. • Use sunscreen. • Tools and equipment will be used in the manner in which it was designed to be used. • Vegetation removal crew will maintain distance of at least 20 feet from each other. • Never fuel equipment in back of a truck with a bed liner. Do it on the ground. • No smoking around fueling operations. • Chainsaw engines will be started and stopped when all co-workers are clear of the saw. • Chainsaws will be properly supported when in use. • Operator will shut off saw when carrying it over slippery surfaces, through heavy brush, and when adjacent to personnel.

		• Saw can be carried with the engine idling for short distances (less than 50 feet) as long as it is carried to prevent contact with the chain or muffler. • Chopping tools with loose or cracked heads or splintered handles will not be used. • Chopping tools shall not be driven as wedges or used to drive metal wedges.

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Vegetation removal equipment: machetes, weed eaters, chain saws, etc. • Footwear with ankle support and non-slip soles (No steel toes around magnetometers). • Back braces, optional. • Communications equipment. • Appropriate clothing and PPE to include protective eyewear, leather gloves, reflective safety vest, hard hat, face shield, hearing protection, and leg chaps. • First aid kit. • Fire extinguishers • WBGT monitor	**Team Leader/UXOSO** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use • Communications equipment checked daily prior to use. • First aid kits checked daily and inspected weekly. • Fire extinguishers checked daily and inspected weekly,	• UXO personnel will meet training and experience requirements outlined in DDESB TP 18. • Site-specific MEC training will be presented to all site personnel. • Site-specific training, slip/fall hazards. • Heat Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • Training in proper lifting techniques. • Training in use of equipment. • Noise prevention training • PPE training. • All site personnel will have current HAZWOPER training.
EOD = Explosive Ordnance Disposal HAZWOPER = Hazardous Waste Operations and Emergency Response MEC = Munitions and Explosives of Concern PPE = Personal Protective Equipment UXO = Unexploded Ordnance		

Activity Hazard Analysis (AHA)

Vegetation Removal

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Activity Hazard Analysis (AHA)

Soil Sampling

Activity: Soil Sampling	**Date: June 19, 2009** **Project: Site Inspection of Waikane Valley Training Area, Kaneohe, HI**
Description of the work: Perform Soil Sampling for Munitions Constituents	**Prepared By: Cheryl Riordan, CSP** **Analyzed By: Robert Crownover** **Review for latest use:** Each time before the job is performed.

PRINCIPLE STEPS	POTENTIAL SAFETY/HEALTH HAZARDS	RECOMMENDED CONTROLS
• UXO personnel will accompany sampling team to site. • UXO personnel will lead sampling team into area and will clear the path of entry into the site. If MEC is encountered, path will be routed around it. • If live MEC is encountered, the area will be marked for disposal. • When sampling team selects location to take sample, UXO personnel, using geophysical equipment, will determine if there are potential MEC beneath the ground surface. • If potential MEC is located below the ground surface, the area for the soil sampling will be moved. • When area that is free of anomalies is located, the soil samples will be taken • In accordance with EPA requirements, soil samples will be collected with clean, stainless steel implements, labeled as to sample number, location, date, time and person taking sample, and the samples will be sent to a certified laboratory for analysis.	• MEC hazards • Uneven working surfaces – slip, trip, fall hazards. • Muscle strains carrying instruments. • Heat Stress • Biological hazards - bees, wasps, parasites feral dogs, feral pigs, and hazardous plants. • Sunburn	• On-site MEC training. • Be observant while walking. Use sturdy leather work boots with ankle support and non-slip soles. • Follow appropriate lifting/ carrying procedures. • Heat stress monitoring, drinking water, work-rest schedule, and cool shelter for breaks. • Training in biological hazards avoidance. • Wear light weight long sleeved shirts and long pants. • Use insect repellant and barrier cream. • PPE Leather work gloves, safety glasses or goggles. • Wear cap for head protection and use sunscreen.

Activity Hazard Analysis (AHA)

Soil Sampling

EQUIPMENT TO BE USED	INSPECTION REQUIREMENTS	TRAINING REQUIREMENTS
• Appropriate geophysical equipment. • Footwear with ankle support and non-slip soles (no steel toes around magnetometers). • Soil sampling equipment and materials. • Back braces (optional). • Communications equipment. • Appropriate clothing and PPE to include leather gloves, safety glasses or goggles, reflective safety vest. • First aid kit. • Fire extinguishers. • WBGT monitor.	**Team Leader/UXOSO** will assure that all controls are being followed; all equipment is being utilized and that all personnel have received appropriate training. • Equipment inspected daily prior to use. • PPE inspected daily prior to use • Communications equipment checked daily prior to use. • First aid kits checked daily and inspected weekly. • Fire extinguishers checked daily and inspected weekly,	• UXO personnel will meet training and experience requirements outlined in DDESB TP 18. • Site-specific MEC training will be presented to all site personnel. • Site-specific training, slip/fall hazards. • Site-specific training/lifting techniques. • Heat Stress symptoms/first aid. • Site-specific flora/fauna to include first aid. • PPE training. • Current HAZWOPER Training.
EOD = Explosive Ordnance Disposal HAZWOPER = Hazardous Waste Operations and Emergency Response MEC = Munitions and Explosives of Concern PPE = Personal Protective Equipment UXO = Unexploded Ordnance		

Activity Hazard Analysis (AHA)

Soil Sampling

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APPENDIX E - ATTACHMENT 3. DIRECTIONS TO THE HOSPITAL

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DIRECTIONS TO THE HOSPITAL

This attachment contains a map and directions to the Castle Medical Center, located at 640 Ulukahiki Street, Kailua, HI. The emergency room phone number is (808) 263-5164. The outpatient clinic phone number is (808) 263-5174.

Figure E3-1: Hospital Route

Mile	Instruction	For
0.0	**Depart Waikane on Local road(s) (East)**	**0.2 mi**
0.2	Turn RIGHT (South) onto SR-83 [Kamehameha Hwy]	8.0 mi
8.2	Road name changes to Local road(s)	21 yds
8.2	Turn LEFT (East) onto SR-83 [Likelike Hwy]	0.4 mi
8.7	Take Local road(s) (RIGHT) onto SR-83 [Kamehameha Hwy]	2.4 mi
11.1	Road name changes to Local road(s)	21 yds
11.1	Turn LEFT (North-East) onto SR-61 [Kalanianaole Hwy]	1.8 mi
12.9	Turn LEFT (West) onto Local road(s)	21 yds
12.9	Keep STRAIGHT onto Ulukahiki St	142 yds
13.0	**Arrive Castle Medical Center [640 Ulukahiki St, Kailua, HI 96734]**	

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APPENDIX E - ATTACHMENT 4. SITE HEALTH AND SAFETY PLAN

This attachment contains the Site Health and Safety Plan for this project.

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ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
CFR	Code of Federal Regulations
°F	Degrees Fahrenheit
DoD	Department of Defense
EM	Engineer Manual
EOD	Explosive Ordnance Disposal
EZ	Exclusion Zone
GPO	Geophysical Prove-Out
MEC	Munitions and Explosives of Concern
MGFD	Munition with the Greatest Fragmentation Distance
MSD	Minimum Separation Distance
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PPE	Personal Protective Equipment
SOW	Statement of Work
SUXOS	Senior Unexploded Ordnance Supervisor
SZ	Support Zone
USAE	USA Environmental, Incorporated
UXO	Unexploded Ordnance
UXOQCS	Unexploded Ordnance Quality Control Specialist
UXOSO	Unexploded Ordnance Safety Officer

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1.0 INTRODUCTION

This Site Health and Safety Plan (SHSP) establishes the responsibilities, requirements and procedures for protecting the project personnel and the surrounding community from the hazards associated with the Remedial Investigation/Feasibility Study (RI/FS) of Waikane Valley Training Area at Kaneohe, Hawaii. This Contract Task Order requires USA to determine the nature and extent of hazards on this site posed by munitions and explosives of concern (MEC) and munitions constituents (MC), and to evaluate the alternatives for various site remedies based on the anticipated future land use.

Work on this site will involve vegetation clearance at each of the four areas of concern (AOC's). A surface clearance will occur for 100% of the AOCs. An instrument test strip will be prepared using simulants of the MEC items expected to be found on these sites, placed at various depths and directions. A local surveyor, registered in the State of Hawaii, will perform location surveying and mapping. An intrusive investigation to depth of detection (2 feet) will be performed throughout the area. Areas determined acceptable for construction of residences and for agriculture, will be investigated to a depth of four feet. Any live MEC encountered will be blown in place. Inert munitions Debris (MD) and other scrap metal will be 100% inspected and will be stored in secured containers until the end of the project, when it will be shipped to a qualified recycler, who will be required to put it through a smelting or shredding operation before it can be re-used. At the end of operations, sites will be backfilled to their original state and re-seeded.

1.1 SITE DESCRIPTION

The site is located in the Waiahole and Waikane Valley on Oahu's windward side (Kaneohe, HI) approximately 10 miles Northwest of Kaneohe Bay. The area had been used for jungle training, field maneuvers and an air-to-ground bombing range. It was later used for maneuvers, tactical problems and small arms, artillery and mortar firing. The lease ended in 1976 and the land was mostly turned back to the original owners. A parcel of 187 acres remains as government property and is fenced due to it being deemed improbable that it can be cleared of all ordnance contamination. Of the 187 acres, 85 acres is in the Potential Recreation area (above 400 feet in elevation); 62 acres are in the Recreational Area (between 300 feet and 400 feet elevation plus a small area in the middle of the site that extends to 500 feet); and the 40 acres that makes up the Residential Area (considered suitable for construction of residences and/or agriculture). Of the 187 acres, this project will involve approximately 102 acres (the Recreational and Residential Areas). The land is a rain forest, with thick vegetation and steep terrain.

1.2 CONTAMINANT CHARACTERISTICS

Based on past usage of the site, it is expected to contain heavy concentrations of MEC contamination to include: small arms, rockets, grenades, and pyrotechnics. Specific rounds identified include the 75mm rifle grenade, 2.36 inch rocket and 3.5 inch rocket. This project will also include soil sampling to determine if explosive constituents have migrated into the soil.

2.0 HEALTH AND SAFETY HAZARD ASSESSMENT

An Activity Hazard Analysis (AHA) has been conducted and documented for each activity warranted by the hazards associated with the activity (see Attachment 2 for the site specific AHAs). The following activity hazard analyses have been prepared for all anticipated field operations:

- Geophysical Prove-Out Test Strip
- Location Surveying and Mapping
- Surface Clearance

- MEC Investigation
- MEC/MPPEH Disposal Operations
- Inspection and Certification of Munitions Debris
- Quality Control
- Vegetation Removal
- Soil Sampling

Should conditions, equipment, or types of operations change during the course of the project work, the Program Safety and Health Manager will update an existing AHA for continuing work, or prepare a new AHA for new operations. The site exclusion zone (EZ) will be based on a minimum separation distance (MSD) of 235 feet around the footprint of the site operations for the protection of the general public, based on the Hazardous Fragment Distance of the 3.5 inch rocket. This separation distance will also be established between UXO teams to protect individual operating units in the event of an accidental detonation while site operations are underway. The MSD is in accordance with Engineer Manual (EM) 1110-1-4009, Engineering and Design Ordnance and Explosives Response, 23 June 2000; United States Army Corps of Engineers (USACE) regulations; and the Memorandum on the Determination of Appropriate Safety Distances on Ordnance and Explosives (OE) Project Sites, OE Center of Expertise (CX) Interim Guidance Document 00-01. If a more hazardous round is encountered at the site, the MSD will be adjusted in accordance with DoD 6055.9 STD.

Risk management is and will continue to be integrated into the planning, preparation, and execution of all operations at the Waikane Valley Training Area site. Risk management is a dynamic process, and is continuously improved upon as personnel become more familiar with the site operations, equipment, and environment. Site personnel are trained to continuously identify hazards and assess accident risks. Once identified, these hazards will be brought to the attention of the Team Leader or UXO Safety Officer (UXOSO). Control measures will be developed and coordinated by USAE safety personnel. All site personnel are responsible for continuous assessment of variable hazards and the implementation of risk controls.

2.1 HAZARD MITIGATION

The hazards listed above will be addressed through a combination of training, engineering controls, and personal protective equipment (PPE).

2.1.1 IMPLEMENTATION OF ENGINEERING CONTROLS AND WORK PRACTICES

Training in site procedures and the use of site equipment can prevent accidents from occurring. Training in recognition of MEC or MEC pieces that could be hazardous will be given to all site workers. When MEC or pieces of MEC are encountered, MEC avoidance will be practiced. Other controls include the MSD of 235 feet, which will provide protection of individual teams from nearby site operations, and will protect the general public from the hazards of site operations.

2.1.2 UPGRADES/DOWNGRADES IN LEVELS OF PERSONAL PROTECTIVE EQUIPMENT

Due to the types of hazards at this site, Level D PPE will be required. This type of PPE is used for levels of contamination that may present a nuisance, but not an identifiable hazard. Level D PPE consists of a hard hat, leg chaps, face shield, safety glasses, hearing protection, leather work gloves, and leather work boots. The hard hat, leg chaps and face shield will only be worn in the vicinity of vegetation clearance operations. If site hazards are encountered that require additional PPE, the PPE level can be increased by the Program Safety and Health Manager, who would base the decision on documented evidence of the hazards. If the site is not as hazardous as originally anticipated, the level of PPE can be downgraded by the Program Safety and Health Manager. This decision would also be based on definitive data that confirms the PPE can be lessened. Normally, downgrading of PPE would require at least one week's worth of data demonstrating that the site is not as hazardous as originally suspected.

2.1.3 WORK STOPPAGE

All personnel are trained to be constantly aware of their work environment. Anyone has the ability to stop operations for safety reasons. No worker is expected to perform any operation for which he has not been properly trained, or to perform any operation that is considered to be unsafe. After operations are stopped for safety reasons, the UXOSO will be notified and will evaluate the situation. The UXOSO will, in consultation with the Program Safety and Health Manager, determine what steps need to be taken to make the situation safe for operations to continue.

2.1.4 EMERGENCY EVACUATION

In the event of an emergency that requires evacuation of the site, verbal instruction will be given by the UXOSO to evacuate the area. Personnel will exit the area to the pre-designated assembly point. After evacuation, the UXOSO will account for all personnel, ascertain information about the emergency and advise responding on-site personnel. The UXOSO will contact, advise, and coordinate with responding off-site emergency personnel if deemed necessary by the situation.

In all situations that require evacuation, personnel shall not re-enter the work area until:

- The conditions causing the emergency have been corrected;
- The hazard has been reassessed;
- The Site Specific Health and Safety Plan has been revised and reviewed with on-site personnel, if needed; and
- Instructions have been given for authorized re-entry by the UXOSO.

2.1.5 PREVENTION AND/OR MINIMIZATION OF PUBLIC EXPOSURE TO HAZARDS CREATED BY SITE ACTIVITIES

The creation of an EZ of 235 feet between the site footprint and the general public, acts as a safety buffer to protect the public from site hazards. Controlling access to the site, closing roads, and installing signs and barricades are all means of keeping the general public from accidentally wandering into the site during operations. There will also be a security guard present during all hours that the teams are not working on site in order to keep unauthorized personnel from entering the site. In addition, the training of all site workers in the hazards and recognition of MEC will reduce the potential for public exposure to hazards. If unauthorized personnel are observed in the EZ, all MEC operations will cease until the area is cleared of unauthorized personnel.

3.0 SAFETY STAFF

See Section 3 of the Accident Prevention Plan.

4.0 HEALTH AND SAFETY STAFF ORGANIZATION AND RESPONSIBILITIES

See Section 3 of the Accident Prevention Plan

5.0 SITE-SPECIFIC TRAINING

See Section 5 of the Accident Prevention Plan.

6.0 SITE-SPECIFIC MEDICAL SURVEILLANCE

Medical surveillance of USAE employees will be conducted in accordance with the requirements of the Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(f), 29 CFR 1910.134(b)(10) and other established guidelines. Personnel to be included in the Medical Surveillance Program will be those who perform hazardous waste operations that may potentially expose the worker to hazardous substances or other significant safety and health threats. All USAE personnel on the project site will participate in the USAE Medical Surveillance Program. Visitors desiring entry into the EZ must participate in their employer's Medical Surveillance Program and must have a current physician's statement prior to entry.

6.1 BASELINE HEALTH ASSESSMENT PHYSICAL OR ANNUAL PHYSICAL

A baseline health assessment physical or annual physical will be conducted prior to participating in site operations, to determine the worker's ability to perform hazardous waste operations in a safe and healthful manner. The Project Manager, in conjunction with the Program Occupational Safety Manager (POSM), will ensure that all health assessments address the site specific health hazards to which workers may be exposed.

Physicals will be scheduled through the POSM, who will contract the services of a board certified occupational medicine physician in the vicinity of the employee's home or job site. The designated physician will perform the medical assessments and review medical examination results to determine each worker's ability to perform his assigned hazardous waste duties. The physician will also be responsible for determining if supplemental or follow-up examinations are required, and for maintaining medical and exposure records in accordance with OSHA 29 CFR 1910.120(d).

The purpose of the Medical Surveillance Program is to:

- Assess the individual's health status prior to participation in hazardous waste operations;
- Determine the individual's ability to perform work assignments that require the use of PPE;
- Establish baseline data for comparison to future medical data in order to provide a means of monitoring a worker's health status;
- Establish facilities and procedures for emergency and non-emergency medical treatment; and
- Establish procedures for maintenance and storage of medical and exposure records.

The USAE medical surveillance program examination consists of:

- Medical and occupational history questionnaire, which includes information on past gastrointestinal, hematological, renal, cardiovascular, reproductive, immunological, and neuralgic problems;
- Information and history of respiratory disease and personal smoking habits;
- Physical examination;
- Blood pressure measurements;

- Complete blood count and differential to include hemoglobin and hematocrit determinations, red cell indices, and smear of peripheral morphology;
- Blood urea nitrogen and serum creatinine;
- SMAC 24;
- Chest x-ray;
- Pulmonary function test;
- Audiogram;
- Echocardiogram for employees over 45 years old, or when other complications indicate the necessity;
- Drug (HR Panel 10) and alcohol screening; and
- Visual acuity.

The following information is provided to the examining physician:

- Description of the employee's duties;
- Anticipated hazardous exposure and levels;
- Description of the PPE commonly used; and
- Information from previous medical exams.

The medical surveillance provided to the employees includes a judgment by the medical examiner of the ability of the employee to use either positive or negative pressure respiratory equipment in accordance with 29 CFR 1910.134. Any employee found to have a medical condition that could directly or indirectly be aggravated by exposure to chemical substances or by the use of respiratory equipment will not be employed for the project requiring clearance under the Respiratory Protection Program. A copy of the medical examination is provided at the employee's request.

The employee will be informed of any medical conditions that would result in work restriction or that would prevent them from working at hazardous waste sites.

Contractors will certify that all their employees have successfully completed a physical examination by a qualified occupational health physician and will supply certification of medical clearance for each on-site employee.

6.2 PHYSICIAN'S STATEMENT

The results of this examination will be made available to the employee and a written physician's statement will be sent to USAE. A copy of the physician's statement will be kept in each employee's file at the project site for the duration of site operations. The physician's statement will include the following:

- The physician's opinion regarding any conditions that would place the employee at an increased risk from working in hazardous waste operations;
- The physician's recommended limitations upon the employee's assigned work, if any; and
- A statement that the employee has been informed by the physician of the results of the examination, and any conditions that may require further examination or treatment.

6.3 SUPPLEMENTAL EXAMINATION

Any site worker who has: been injured; received health impairment; developed signs or symptoms from possible over-exposure; or received a documented over-exposure without the use of respiratory protection, will undergo a supplemental examination. The contents of this examination will be based upon the type of injury, illness, signs or symptoms of exposure involved and will be determined by the physician. Prior to reassignment to site activities, the physician will certify that the employee is fit to return to work. If necessary, the physician will specify in writing any activity restrictions or additional tests that may be required.

6.4 FOLLOW-UP HEALTH ASSESSMENTS

If, during any pre-assignment, annual or supplemental examination, a condition is detected that requires follow-up tests, the physician will notify USAE and the employee as to the nature of the follow-up health assessment. The physician will determine the schedule and content of the follow-up health assessment. A statement outlining the employee's fitness for work will be provided to USAE and the employee upon conclusion of the follow-up health assessment.

6.5 EMERGENCY AND NON-EMERGENCY MEDICAL TREATMENT

USAE will have an Emergency Medical Technician (EMT) assigned to the site as well as a minimum of two site workers certified in First Aid/CPR. The EMT, with assistance as needed from the First Aid/CPR certified workers will act as the first responders on site in the event of an accident or injury. They will provide emergency first aid services until professional medical personnel arrive on site to take over the treatment. The EMT will take care of all first aid and non-serious injuries to site personnel and will inform the UXOSO when such injuries occur. For serious injuries, the medical treatment facility for use at this project site will be the Castle Medical Center at 640 Ulukahiki Street, Kailua, HI. For map and directions to Castle Medical Center, please refer to paragraph 12.2.9.1 in the Accident Prevention Plan.

6.6 MEDICAL RESTRICTION

Should an occupational injury or illness occur that restricts an employee's ability to function at full capacity, USAE maintains a policy of providing these employees with restricted duty assignments whenever possible to allow them to continue to be productive.

6.7 RECORD KEEPING

USAE will retain and maintain copies of all physician statements, exposure records, and associated information for USAE employees involved in hazardous waste operations, in accordance with the requirements of 29 CFR 1910.120(f). These records will be kept at the project site for the duration of site operations. When the site work is complete, the records will be retained by USAE at the Corporate Office located in Oldsmar, FL. Examining physicians will be responsible for maintaining records related to laboratory analyses and other tests for each USAE employee examined. All records, whether maintained by USAE or by the examining physician, will be kept on file for a period of 30 years beyond an employee's termination.

7.0 PERSONAL PROTECTIVE EQUIPMENT

The Personal Protective Equipment Program for USAE is described in the Personal Protective Equipment section of the Accident Prevention Plan (APP). Due to the expected hazards at this site during most operations, Level D PPE will be required. Level D PPE is a work uniform affording minimal protection, used for nuisance contamination only. The following Level D equipment will be required on this site:

- Hard hat, when working around vegetation removal operations
- Face shield – when working around vegetation removal operations
- Leather gloves
- Safety glasses with side shields or safety goggles
- Hearing protection, where required by high noise levels, in the vicinity of vegetation clearance operations
- Leather work boots with ankle support and non-slip soles
- Cotton work clothes
- Back supports (optional)
- Leg chaps – when working around vegetation removal equipment
- High-visibility reflective safety vest (meeting the requirements of ANSI/ISEA 107-1999 or later).

8.0 MONITORING AND SAMPLING PLANS

Chemical monitoring will not be required as no significant exposure to hazardous chemicals at this site is expected. Soil sampling will be conducted on the site in order to determine the extent of soil contamination from munitions constituents. Chain of Custody requirements will be applicable to soil sampling on this site. While personnel performing vegetation removal operations will be provided with hearing protection, noise monitoring may also be conducted. If the noise exposure level can be consistently demonstrated to be below the action level for noise, (i.e., at least one week of readings below 85 dBA) the Program Safety and Health Manager may decide to reduce this requirement based on monitoring results. Workers on this site will normally be in Level D PPE; however, heat stress monitoring will be required if the temperature goes above 75˚F. Should heat stress monitoring be required, site monitoring data will be recorded using the Site Monitoring Log and will be maintained as part of the project record.

8.1 SOIL MONITORING

Soil monitoring will be performed in order to determine the extent of soil contamination by munitions constituents. Prior to performing soil sampling, the area to be sampled will be surveyed by a UXO Technician with a magnetometer, in order to assure there is no buried MEC in the vicinity of where the sampling will occur. If potential buried MEC is detected, the sampling will be moved to another area where no anomalies are detected. In accordance with EPA requirements, all samples will be taken with clean, stainless steel implements, properly labeled and sealed and shipped to a certified laboratory for testing. Chain of Custody requirements will be strictly enforced and records will be maintained. The number of samples taken will depend upon the size of the sampling area and the amount of contamination detected. Enough samples will be taken to adequately characterize the extent of contamination by MEC constituents at each of the AOCs.

8.2 HEAT STRESS MONITORING

Heat stress monitoring will be conducted using temperature readings, obtained from an on-site WBGT, in order to assure adequate work/rest cycles are determined and implemented at the site. When the temperature approaches 75˚F or above, heat stress monitoring is required. Monitoring will be performed by the UXOSO and results will be documented. The WBGT readings may also be supplemented by pulse rate monitoring, body temperature monitoring, and/or body fluid weight loss monitoring, at the discretion of the UXOSO, if he feels it is necessary to assure all site personnel are adequately acclimatized to the site conditions. All site monitoring records for heat stress will be maintained on site for the duration of site operations, after which they will become part of the official project files. Plenty of cold drinking water will be available on site to maintain hydration of site personnel.

8.3 METEOROLOGICAL MONITORING

Rain can constitute a safety hazard to field operations at this site. The UXOSO will be responsible for monitoring the weather closely. If the area becomes wet, muddy, or slippery such that an unacceptable level of risk exists for personnel who are working in proximity to MEC items, then site operations will cease until the UXOSO determines the area as safe to continue.

No site operations will take place if an electrical storm is within 10 miles of the site. An electrical storm monitor will be used to determine if an electrical storm is approaching. Site operations will cease when an electrical storm is within 10 miles of the site, and will not resume again until the UXOSO determines that the electrical storm is at least 10 miles away from the site. Personnel will evacuate the site to the pre-designated evacuation point and will await the determination by the UXOSO that it is safe to resume operations.

8.4 PERIMETER MONITORING

No perimeter monitoring of USAE operations will be required on this site.

9.0 HEALTH AND SAFETY WORK PRECAUTIONS AND PROCEDURES

Using common sense and following safe practices can reduce hazards. Personnel must keep the prudent guidelines listed below in mind when conducting field activities.

- Hazard assessment is a continuous process. Personnel must be aware of their surroundings and constantly be aware of MEC, chemical and physical hazards that are or may be present.
- The number of personnel in the EZ will be the minimum number necessary to perform work tasks in a safe and efficient manner.
- Team members will be familiar with the physical characteristics of each site including wind direction, site access, and the location of communication devices and safety/emergency equipment.
- Detection or appearance of unusual or unknown liquids, odors or discolored soil could indicate the presence of contaminants and should be reported to the UXOSO immediately.
- Site personnel are to report any other unusual or potentially hazardous condition to the UXOSO for investigation and/or corrective action.

9.1 SITE RULES/PROHIBITIONS

All personnel on site will be required to follow the safe work practices contained in this Plan, as they relate to the hazards encountered during site activities. All site personnel will be required to read, understand, and comply with the provisions of this SHSP. If new tasks or hazards are identified during site operations, which pose additional hazards, the SHSP will be amended by the POSM to include additional safe work practices and other control methods as needed.

9.1.1 SAFE PRACTICES

Safe practices can reduce hazards associated with normal site activities. Personnel must keep the prudent guidelines listed below in mind when conducting field activities. General personnel requirements include:

- Horseplay or fighting is prohibited.
- Eating, drinking, smoking, chewing gum, tobacco, or any other hand-to-face activities are prohibited on site, except in designated areas after both face and hands have been washed.
- Wearing contact lenses is prohibited in the EZ.
- When required to sit or kneel on the ground, avoid contaminated surfaces.
- Placing equipment on contaminated surfaces should be avoided.
- Climbing on or over obstacles is prohibited. Stacks of materials can be unstable and could cause injury.
- Open flames of any type are prohibited on site.
- Bringing defective or unsafe equipment on site is prohibited.

Only authorized employees may enter the work site. Visitors must check in with the UXOSO, receive an appropriate safety briefing, and be escorted by UXO-qualified personnel at all times while on site.

9.1.2 BUDDY SYSTEM

The buddy system is a safety practice in which each individual is concerned with the health and well being of co-workers. The buddy system will be implemented during all on-site activities and will be incorporated when workers may be isolated or as determined by the UXOSO. The UXOSO will assign "buddies" to ensure accounting of all site personnel. Additional procedures include:

- A minimum of two personnel, with one being a UXO-qualified person, will be present during all MEC operations to ensure that one person will always act as a safety observer. During all MEC operations, only the minimum number of personnel required to safely perform the task will be allowed on site. All other personnel will evacuate to a pre-designated assembly point.
- At no time will an individual desert his "buddy" unless his "buddy" goes down, and it is considered too hazardous to render assistance. "Buddies" will enter and exit the EZ together and frequently monitor one another for signs of fatigue, heat stress, and any other problems. In such cases, the worker in danger may not be aware he/she is having a problem. The "buddy" must always be alert to changes in the behavior of his "buddy" so that he can remove him/her from the situation immediately.
- "Buddies" should frequently inspect each other's equipment, including PPE, to ensure that it is adequate and in proper working order.

9.2 WORK PERMIT REQUIREMENTS

At this time USAE does not anticipate work permits for the work associated with this project. Under the Statement of Work (SOW) and activities anticipated for this project, there are no requirements for hot work, (welding). All site personnel will utilize the general fire safety precautions and procedures to eliminate the hazards from ignition sources. There are expected to be no confined spaces or radioactive work on this project. Should this situation change, this SHSP will be updated to include these additional hazards, and shall handle them in accordance with the USAE Corporate Safety and Health Program, which addresses all of these issues.

9.3 MATERIAL HANDLING PROCEDURES

Many types of objects are handled in normal day-to-day operations. Care will be taken and training will be provided to all personnel for lifting and handling heavy or bulky items, as this is the cause of many joint and back injuries. The following fundamentals address the proper lifting of materials to avoid joint and back injuries:

- The size, shape, and weight of the object to be lifted must be considered. Site personnel will not lift more than they can handle comfortably.
- A firm grip on the object is essential; therefore, the hands and object will be free of oil, grease, and water, which might prevent a firm grip.
- The hands, and especially the fingers, will be kept away from any points that may 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 will be used, if necessary, to protect the hands.
- 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, making sure that the back is kept as straight as possible.
- To lift the object, the legs are straightened from their bending position.
- Never carry a load that cannot be seen over or around.
- When placing an object down, the stance and position are identical to that for lifting, with the back kept straight, the legs bent at the knees, and the object lowered.
- If the item to be lifted is too large, bulky, or heavy (over 50 pounds) for one person to safely lift, ask a co-worker for assistance. If a piece of material handling equipment is available that can do the job, the employee should use the equipment instead of trying to lift the object himself/herself.
- 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, will face the direction in which the object is being carried.

9.4 SPILL CONTAINMENT

Major spills are not expected on this site. Hazardous materials, where necessary, are being brought to the site in small quantity containers. This will minimize the amount of material involved, should a spill occur, as well as reduce the amount of hazardous material on hand to the minimum amount consistent with efficient operations. If a small amount of liquid hazardous material is spilled, it will be cleaned up with absorbent material by site personnel wearing appropriate chemical resistant gloves. It will then be containerized, labeled, and sent for disposal at an approved facility.

9.5 DRUM, CONTAINER, AND TANK HANDLING

USAE does not anticipate the use of drums, containers, or tanks during activities under the SOW.

9.6 COMPREHENSIVE ACTIVITY HAZARD ANALYSIS OF TREATMENT TECHNOLOGIES

Treatment technologies are not expected to be used on this project. This is a MEC avoidance project.

9.7 MATERIAL SAFETY DATA SHEETS

The Material Safety Data Sheets are located in Attachment 6.

9.8 SUBCONTRACTOR CONTROL

See the "Subcontractors and Suppliers" section of the Accident Prevention Plan.

10.0 SITE CONTROL MEASURES

Site control measures are used to prevent or minimize the potential for site hazards. The site control measures as well as all requirements of this SHSP are mandatory for all personnel entering the EZ of this project site. Authorized government personnel will undergo the mobilization training along with all USAE personnel and any subcontractors who may be required to work on this site, which includes a briefing in all of the requirements of this SHSP. All personnel receiving this training must sign a statement that they were trained and fully understand the requirements of this SHSP.

10.1 SITE MAP

A site map (see Appendix A for detailed site maps) will be utilized by the UXOSO during the tailgate safety briefing to inform the workers of the location of hazardous areas on the site, the assembly areas to be used in the event of site evacuation, and any other information relevant to the day's activities. The site map will include:

- Site topography
- Site work zones
- Location of unusual/hazardous areas
- Prevailing winds
- Ingress and egress corridors
- Evacuation routes and assembly points
- Location of emergency supplies

10.2 WORK ZONE DELINEATION AND ACCESS POINTS

Site work zones will be established by the UXOSO prior to initiating operations to control site access. Establishment of site work zones is based upon site conditions, activities, and exposure potentials. A site EZ will be set up, which includes the footprint of the area where work will take place and a 235 foot separation distance around that to protect areas outside the site from potential site hazards. Within the EZ, operating teams will maintain a 235 foot MSD to protect the teams from each other's operations. Site work zones will be marked using barricades and signage closing roads into the area to unauthorized vehicular traffic. Barricades and signs will remain in place for the duration of site operations. There will also be a guard posted during hours when the site is not in operation to keep unauthorized personnel from entering.

10.3 SITE ACCESS CONTROL

The UXOSO will control access to each work zone and will ensure that all site workers and visitors have received the proper training and medical surveillance required to enter a specific zone. Access will be denied to any potential entrant not meeting these requirements. The following work zones will be established at this site:

- Exclusion Zone (EZ) – Area where a significant hazard does or could occur and includes all areas where PPE is required to control worker exposure to chemical or physical hazards. All personnel entering the EZ will be logged in/out by the UXOSO. All visitors to the EZ must be escorted by a UXO-qualified USAE employee (normally this would be the UXOSO). The EZ of this site will be designated as the footprint area of actual project operations and the required separation distance of 235 feet surrounding the area. Entry into the project area where the work will be performed will be under the control of USAE. USAE will control use of the roads inside the project area where the work is taking place. When personnel who are not UXO qualified are required to enter within the exclusion zone, all UXO operations will cease until all unrelated personnel are outside of the exclusion zone.
- Support Zone (SZ) – Area outside the EZ where site support activities are conducted. This zone includes break areas and sanitation facilities. Visitors desiring entry into the EZ must first meet with the UXOSO and receive the appropriate safety and emergency procedures briefing in the SZ before gaining admittance to the EZ. In addition, visitors will be escorted at all times by a UXO-qualified employee while in the EZ.

Site access control will be implemented by USAE and will be accomplished through a program that limits movement and activities of people and equipment at the project site. This control will be based on site-specific characteristics to include:

- Potential chemical, biological, physical or explosive hazards;
- Terrain;
- Expected weather conditions;
- Planned site activities; and
- Site proximity to populated areas.

The degree of site access control will include the following:

- Controlled site ingress/egress points – Work area will be clearly visible to anyone approaching the site and vice versa. The access road leading into the area will be closed and barricaded. Signs will be posted to warn unauthorized personnel against entry into the area. Anyone entering the work area must clear access through USAE. Only authorized personnel will be permitted within the EZ during MEC operations. All others will remain in the SZ. A security guard will be at the site during hours when the site is closed, to assure unauthorized personnel do not enter.
- Worker/visitor registration – All personnel working on the site sign in daily at the time of their daily safety briefing in the morning. All visitors to the site must sign the visitor log when they report to the site for their visitor briefing.
- Escort of visitors – All visitors to the site will be escorted by a UXO-qualified USAE employee. Visitors will be briefed on site hazards, PPE requirements, and emergency procedures. Visitors who are not UXO-qualified will not be permitted within the EZ during MEC operations. If visitors need to access the EZ, all MEC operations will cease while they are in the area, and the visitors will be escorted at all times.

- PPE requirements – PPE requirements have been established based on the site hazards. Personnel working in areas requiring PPE will wear required PPE for the duration of the operation. Visitors to the area will be required to have the required PPE for the area they will be visiting.

10.4 ON AND OFF-SITE COMMUNICATION SYSTEM

On-site communication will be conducted by voice or hand signals. If off-site communication is required, it will be established through the use of cellular telephones. The SUXOS and UXOSO will have cell phones available and all site vehicles will be equipped with a cell phone. The list of emergency telephone numbers will be posted in each site vehicle and with each cell phone.

11.0 PERSONNEL HYGIENE AND DECONTAMINATION FACILITIES AND PROCEDURES

Sanitation facilities will be provided in the support zone area so that employees can wash prior to eating, drinking, smoking, or engaging in any other hand-to-face activities. Chemical toilets will be available in the support zone of the work area. As chemical contamination is not expected to be an issue at this site, basic washing of equipment and standard hygiene practices are the minimum requirements. Site sanitation will be established and maintained in accordance with OSHA 29 CFR 1910.120(n) and USACE EM 385-1-1, Section 2. In particular:

- Temporary toilet facilities will be provided in the work areas of the site. Chemical toilets will be used in these locations and will be serviced every week. Each temporary toilet will be naturally lighted, have a toilet seat with a seat cover, have a urinal, have ventilation with vents screened, and be lockable from the inside. There will be at least one toilet for every 15 workers at the work site, as required.
- Hand and face washing facilities will be set up at the USAE work site and will be utilized by all personnel exiting the EZ prior to eating, drinking, tobacco use, or other hand-to-face activities. Paper towels will be provided for drying. A trash receptacle will be provided for discarded paper towels. In accordance with ANSI Z358.1-1998, eye-wash facilities will be available on all work sites where operations involve handling substances that could be hazardous to the eyes. An eyewash kit will also be located in each site vehicle.

General work practices include the following:

- Safe work practices will be implemented when possible to eliminate or reduce the potential for employee exposure.
- Employees will wash their hands immediately or as soon as feasible after removal of gloves or other PPE.
- Employees will wash hands and any other skin with soap and water, or flush mucous membranes with water immediately following contact with blood or potentially infectious materials.
- If potentially contaminated sharps are encountered, the item will immediately be disposed of in an appropriate container or decontaminated.
- Eating, drinking, smoking, applying cosmetics or lip balm, handling of contact lenses, or storage/handling of food are prohibited in all areas where potentially infectious materials are present.
- Equipment that has become contaminated will be decontaminated prior to servicing or storage, unless decontamination is not feasible, in which case the equipment will be disposed of properly.

12.0 EQUIPMENT DECONTAMINATION FACILITIES AND PROCEDURES

Due to the fact that chemical contamination is not anticipated at this site, basic washing of equipment is all that will be required.

13.0 ON-SITE FIRST AID AND EMERGENCY PROCEDURES AND EQUIPMENT

An approved emergency first aid kit, blood-borne pathogen kit, CPR mask, stretcher, blankets, eye wash kits, trauma supplies, and basic emergency equipment will be kept in the EMT vehicle. First aid kits are assigned by the Safety Office and approved by the Occupational Health Physician. An EMT will serve as the first responder to any site emergency. Site personnel certified in First Aid/CPR may be requested to assist the EMT in responding to site emergencies. The UXOSO will be charged with providing regular inspections of the emergency supplies, replacing any items that are used, and maintaining readiness. Any emergencies will be reported immediately to the UXOSO, who will consult with the EMT to make the determination as to whether professional medical treatment is required. The UXOSO will call for an ambulance in case of a serious emergency, or he will drive the victim to the hospital for situations that are not life-threatening, but still require professional medical care.

Portable eyewashes will be located in the work area. Where eyewashes are required by OSHA due to specific eye hazards, they will be in compliance with ANSI STD.Z-358.1-2004 or later. Where not specifically required by OSHA, eyewash bottles will be maintained with the first aid kit in the site vehicles.

A 5-pound ABC fire extinguisher will be kept in each site vehicle for emergency use on site. This equipment will be inspected on a weekly basis to assure it is maintained and ready to use. Any used items will be replaced immediately.

Fire extinguishers will be stored where they are well marked and readily accessible. Fire extinguishers shall be protected from the damaging effects of environmental elements. The UXOSO is responsible for ensuring that all fire extinguishers are visually inspected monthly and that these inspections are documented. All site personnel will be familiar with the locations of fire extinguishers and will be trained in their use.

14.0 EMERGENCY RESPONSE PLAN AND CONTINGENCY PROCEDURES

The Emergency Response Plan and contingency procedures address emergencies that could occur during site operations, and outlines the appropriate response actions. This information can be found in “Emergency Response Plan and Contingency Procedures” under the “Plans, Programs and Procedures” Section of the APP.

15.0 EVACUATION PLAN

In the event of an emergency requiring evacuation, the evacuation signal will be given as an alarm or through verbal instructions. Personnel will evacuate to a pre-determined evacuation point in the support zone. The UXOSO will account for all personnel and will summon emergency response personnel, if required. If the Fire Department is summoned, the UXOSO will meet them upon their entrance to the site and will inform them of the presence of MEC, and provide the appropriate fragmentation distance from the fire for the purpose of fighting or preventing the spread of fire from the site.

Potentially hazardous weather conditions will be closely monitored by the UXOSO. The UXOSO will determine if high wind or heavy rain conditions pose a hazard to site operations, in which case, personnel will evacuate to the pre-determined evacuation point and will wait for conditions to clear or for further instructions from the UXOSO.

After the emergency situation has been controlled and eliminated, or has passed the Project Manager, UXOSO, and POSM will review the way the emergency was handled and change procedures if necessary.

After allowing the appropriate wait time (24 hours in the case of a fire), the SUXOS and the UXOSO will enter the site together and determine if the site is safe for re-entry. If MEC is encountered that may have been subjected to extreme temperatures in a fire, that MEC will be disposed of in a blow in place operation, as exposure to the extreme heat of a fire would make it unacceptable to move it.

16.0 LOGS, REPORTS, AND RECORD KEEPING

See the “Logs, Reports and Record Keeping” section of the APP.

17.0 ON-SITE WORK PLANS

The approved Work Plans will be maintained on site by the SUXOS, UXOSO, and UXOQCS, which include the Accident Prevention Plan/Site Specific Health and Safety Plan, the Explosive Safety Submission, and the Quality Control Plan. These plans will be fully implemented for the duration of site operations. If new hazards are encountered that are not fully addressed within these documents, the documents will be amended in accordance to the requirements of DoD 6055.9 and will be sent for approval through the same appropriate channels that approved the original plans.

18.0 COMMUNICATION PROCEDURES

On-site communication will be verbal within the individual groups. Communication between groups will be via radio and/or cellular telephone. There may also be an alarm signal used for the purpose of site evacuation.

Off-site communication and between-site communication will be by cellular telephone. Telephones will be available in each site vehicle and the list of emergency telephone numbers will be posted with the telephone.

19.0 SPILL CONTAINMENT PROCEDURES

Small quantity containers of chemicals will be used at the work site, which will minimize the amount of hazardous materials that could potentially become part of a spill should an accident occur. The majority of chemicals used will include oils and lubricants for use in vegetation clearance equipment. Spill clean-up kits will be available for use to clean up these chemicals and the impacted soils in the event a spill occurs. Chemical resistant gloves will be used during all cleanup activities. The spilled chemical and the contaminated soil will be cleaned up, placed in labeled plastic bags, and stored in drums or other secured location until such time as they can be removed from the site and sent to a certified disposition facility.

20.0 CONFINED SPACE PROCEDURES

Due to the nature of this SOW, confined spaces are not expected to be an issue on this site.

21.0 FIRE PROTECTION REQUIREMENTS

Through appropriate use and storage of flammable products, USAE intends to prevent fires as much as feasible during operations on this site. Should a fire occur, all site teams will have at least one ABC fire extinguisher with them during the course of operations. Fire extinguishers are the first line of defense should a fire start in this location. USAE personnel will be trained in the use of fire extinguishers and they will be instructed to try to fight a fire only in the incipient stages. If the fire is too large to fight, personnel will evacuate the site and the UXOSO will call in the Fire Department, who will stand no closer than fragmentation distance from the fire to fight or prevent spreading of the fire. If it is possible to safely do so, USAE will remove any flammable and/or combustible materials from the path of the fire.

After the fire has been extinguished, the area will be closely monitored by the UXOSO for a period of at least 1 hour for a small fire, to assure that re-ignition does not occur. For larger fires or explosions, a wait time of 24 hours will be given after the fire has been extinguished before anyone would be permitted to gain access to the site. At that point, the SUXOS and the UXOSO would enter the site together. If MEC is observed, it will be considered to be unstable due to exposure to extreme heat. This MEC will be blown in place. After all visible MEC has been disposed of, it is considered safe for other personnel to enter the site for the purposes of site investigations. All personnel entering the site who are not UXO-qualified will be escorted by a UXO-qualified person for the duration of the site visit. If MEC is encountered while non UXO-qualified personnel are visiting the site, they will be removed from the site until the MEC can be blown in place and the site can be made safe for re-entry.

22.0 INCIDENT REPORTING REQUIREMENTS

Should an accident or mishap occur on the site, regardless of the severity, it will be fully investigated by USAE and all reports and records will be documented on the USAE Accident Report Form and the Contractor Significant Incident Report (CSIR-1). Copies will be maintained on site for the duration of site activities. A permanent copy will be maintained in the USAE Oldsmar, Florida Office. Accidents/incidents shall be reported in accordance with EM 385-1-1. All accident/incident reports will be reviewed by the Program Occupational Safety Manager and the Program Safety and Health Manager to assure all root causes of the accident/incident have been adequately addressed in order to prevent future recurrences on this or any other project sites.

The Site Manager will notify the Navy technical representative immediately of an accident that appears to have any of the consequences listed below and fill out and submit the CSIR-1 form to the Contracting Officer or designated representative for review within one working day after the event.

- A fatal injury
- Permanent total disabling injury
- Permanent partial disabling injury
- Three or more persons admitted to a hospital
- Property damage in the amount of $100,000 or more.

Any accident involving a fatality or three or more hospitalizations from the same incident will be reported telephonically to the nearest OSHA Area office within 24 hours by the Program Safety and Health Manager. If all information is not known at that time, an initial report will be made and a follow-up report will be submitted after all of the facts are documented.

APPENDIX E - ATTACHMENT 5. DRUG FREE WORK PLACE PROGRAM

This attachment contains a copy of USAE's Drug Free Work Place Program.

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DRUG FREE WORK PLACE PROGRAM

January 1, 2009

The USA ENVIRONMENTAL, INC. program is an extension of our work safety and employee health programs. The program requires refraining from substance abuse both on and *off* the job as a condition of continued employment.

WHAT IS SUBSTANCE ABUSE?

Federal Acquisition Regulation Clause 23.500 defines substance abuse as the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance in the workplace. USA ENVIRONMENTAL INC.'s program further expands that definition as follows: Substance abuse includes but is not limited to the consumption, by any means, of any legal or illegal substance that alters an individual's normal behavior and results in intoxication and/or renders the employee incapable of safe/efficient job performance. Substance abuse also includes over use or abuse of legally prescribed drugs. Also prohibited are the selling, trading, giving away, possession or offering for sale illegal drugs, prescription drugs, or alcohol whether on company property, while operating a company vehicle or company-leased vehicle (on or off company property and during working or non-working hours), or operating a personal vehicle while on company business.

USA ENVIRONMENTAL SUBSTANCE ABUSE TESTING PROGRAM

The substance abuse program includes substance abuse testing under the following situations:

1. Pre-employment testing.
2. Testing for reasonable suspicion of substance abuse.
3. Testing following on-the-job accidents.
4. Testing as part of all "fitness for duty" medical examinations.
5. Quarterly testing for a period of 2 years after program completion for all employees participating in a substance abuse rehabilitation program.
6. Random testing of employees to promote abstinence.
7. Testing following a 30-day or greater layoff or return to work following a leave of absence or termination.

A urine, saliva or blood specimen will be analyzed for the presence of any of the following substances:

1. Marijuana - Cannabinoids, THC
2. Cocaine
3. Methadone - Dolophine, Methadose
4. Barbiturates - Nembutal, Tuinal, Seconal, etc.
5. Amphetamines - Desoxyn, Biphetamine, Dexedrine, etc.
6. Methaqualone - Qualudes
7. Opiates - Codeine, Percodan, Paregoric, Morphine, etc
8. Propoxyphene - Darvon, Dolene, etc.
9. Phencyclidine - (PCP)
10. Benzodiazepines - Librium, Valium, Xanax, Serax, Halcion, etc.

(Alcohol as required – Ethyl Alcohol as a beverage or as part of a medication)

A list of the most common drugs or medication by brand name, common name, as well as chemical name, which may alter or affect a drug test will be provided to all job applicants and employees at the time of testing.

A form is provided for employees or job applicants to report, voluntarily and confidentially, the use of prescription or non-prescription medications both before and after being tested.

Specific confirmation testing will be performed for all positive screening test results. Employees testing positive for prescription drugs that are commonly abused must produce evidence from their attending physician to justify the treatment necessity for use of the drug(s).

USA ENVIRONMENTAL, INC. is responsible for testing costs, except for test costs incurred by the employee or job applicant challenging test results.

RANDOM TESTING

Unless prohibited by law, USA ENVIRONMENTAL, INC. reserves the right to randomly test its employees for substance abuse. The number of personnel tested and the frequency of tests will be solely at the discretion of USA ENVIRONMENTAL, INC. or as contractually specified by USA ENVIRONMENTAL INC.'s clients.

REASONABLE SUSPICION TESTING .

Employees reporting to work or a USA ENVIRONMENTAL, INC. job site who demonstrate impaired conduct will be interviewed by two (2) supervisors or managers to determine the cause of the irregular behavior.

If both supervisors conclude that the irregular behavior is unsafe the employee will not be allowed to continue working and will be transported home or to a medical facility. The employee will not be allowed to drive any motor vehicle. If a medical problem is not the cause, the employee may be tested for substance abuse. The employee may also be tested for substance abuse regardless of the cause of irregular behavior.

Reasonable suspicion testing shall also be conducted when there is:

1. An independently corroborated report of observed substance abuse.
2. Evidence that an individual tampered with a drug test during his or her employment with USA ENVIRONMENTAL, INC.
3. Information that an employee caused or contributed to an accident while at work.
4. Evidence that an employee has used, possessed, sold, solicited, or transferred drugs while working on USA ENVRIONMENTAL, INC. premises or while operating vehicles, machinery or equipment belonging to USA ENVIRONMENTAL, INC.

Supervisors will complete an incident report for observed irregular conduct, documenting their observations and the results of the employee interview. Final disposition of the incident will be documented with signatures and the dates listed by both supervisors.

A copy of the supervisor's report will be provided to the employee with appropriate employee's signature of receipt.

This confidential Incident Report will be retained by USA ENVIRONMENTAL, INC. for a period of at least one (1) year.

CONSEQUENCES OF POSITIVE TEST OR TEST REFUSAL

Refusal or failure to submit to testing or positive test results following an on-the-job injury disqualifies an employee from Workers' Compensation benefits.

Testing positive for abused substances will eliminate applicants from employment consideration.

Any employee may be terminated from employment for a positive test result. Refusal or failure to submit to testing following an on-the-job accident or random test will result in termination of employment.

Any employee who is given a "second chance" must seek treatment. Time away from work for treatment will be in a leave without pay status. The USA ENVIRONMENTAL, INC. Employee Assistance Program (EAP) will coordinate the employee's treatment plan. If the employee is enrolled in the employee health benefit plan or another medical plan, it may provide benefits to help pay for this treatment.

A second positive test for abused substances will result in termination.

OTHER GROUNDS FOR TERMINATION

An employee bringing onto the USA ENVIRONMENTAL, INC. premises or job sites; having possession of; being under the influence of; possessing in the employee's body, blood or urine (at levels exceeding or equal to established cut-off levels, 38F-9.007 (4)); or using, consuming, transporting, selling, attempting to sell, or giving away any illegal drugs (including prescription drugs illegally obtained or prescribed for the individual only), or alcohol, at any time, is guilty of misconduct and is subject to discipline to include discharge, suspension without pay or other actions even for a first offense. USA ENVIRONMENTAL, INC. reserves the right to inspect the property and person of individuals suspected of illegal drug or alcohol possession while on company property or at company job sites (see Right to Inspect).

CHALLENGING TEST RESULTS

An employee may challenge a confirmed positive test by submitting an explanation in writing to the Human Resources Department concerning personal circumstances that might have affected test results. This challenge must be submitted within 5 working days following the employee's notification of a confirmed positive test result. The donor of a tested specimen will be responsible for providing all necessary documentation, i.e., a doctor's report, signed prescription or current prescription container with relevant information and other related supporting documents.

USA ENVIRONMENTAL, INC. will, within 15 days of receipt of the employee's written explanation or challenge of positive test results, provide a written explanation to the employee as to whether, and if so, why, the employee's explanation is unsatisfactory, along with a copy of the positive test results.

The employee or job applicant desiring to challenge a test result will be responsible for notifying the original testing laboratory of an alternate HRS licensed laboratory, for the purpose of transferring, under Chain of Custody, a portion of the employee's or job applicant's specimen for re-testing. The employee may have a portion of their original specimen re-tested during a period of 180 days following written notice of a positive test result. When an employee undertakes a challenge to the result of a test, it shall be the employee's responsibility to notify the laboratory and the sample shall be retained by the laboratory until the matter is settled. Retesting will be at the employee's expense.

In the case of a denial of a workers' compensation claim, an employee may undertake an administrative challenge by filing a claim for benefits with a judge of compensation claims, concerning workplace injury. Other challenges not involving workplace injuries must challenge a test result in a court of competent jurisdiction.

Employees or job applicants may call the testing laboratory for technical information regarding prescription or non-prescription medications that may affect test results.

Employees and job applicants may report, in confidence, to their manager or Human Resources Director, the use of prescription or non-prescription medications that may affect job performance or testing results, either before or after testing.

Job applicants or employees whose drug test results are confirmed positive shall not by virtue of the result alone, be defined as having a "disability" under the Americans with Disabilities Act.

GETTING HELP

Employees who require a treatment program will be referred to USA ENVIRONMENTAL, INC.'s Employee Assistance Program (EAP).

Employees may inspect this program file and/or receive more information on the program on a confidential basis, in the USA ENVIRONMENTAL, INC. Human Resources Office, during normal hours of operation.

REQUIREMENT TO NOTIFY USA OF A CONVICTION

Any employee convicted of a criminal drug statute violation must notify USA ENVIRONMENTAL, INC., Attention: Human Resources Department, within 5 calendar days of the conviction. This notification must be in writing.

CONFIDENTIALITY OF INFORMATION

All drug test information, reasonable suspicion reports, or other related information concerning an employee or applicant will remain confidential and will not be disclosed except under conditions required by law.

Release of such information under any circumstances, other than those required by law, will be solely pursuant to a written consent voluntarily signed by the person tested. The consent duration and precise information to be disclosed will be stated.

GOVERNMENTAL COMPLIANCE

The Drug Free Work Place Program is implemented pursuant to the requirements of Florida Statute 440.102 and Administrative Rules 38F-9-001 through 38F-9.014 of the Florida Department of Labor and Employment Security, Division of Workers' Compensation, and 48 CFR 23.500 (Federal Acquisition Regulation 23.500). Laws may be amended at project sites in other states due to those states' requirements.

Robin Miller
Human Resources Director

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APPENDIX E - ATTACHMENT 6. MATERIAL SAFETY DATA SHEETS (MSDS)

This attachment contains the following Material Safety Data Sheets (MSDSs) required for use on this project.

- Deep Woods Off
- Diesel
- Fire Extinguishers
- Insect Repellent
- Unleaded Gasoline

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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

HMIS 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

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

TERATOGENICITY : NONE KNOWN
MUTAGENICITY :NONE KNOWN

MSDS
DEEP WOODS OFF

FIRST AID PROCEDURES

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 ARTIFICIALRESPIRATION, 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
HMIS CLASSIFICATION : REGULATED UNDER P.C.P. ACT NO. 22258

The Valvoline Company Date Prepared: 05/12/03

MSDS No: 999.0013902-009.001I

DIESEL FUEL #2

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1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material Identity
Product Name: DIESEL FUEL #2
General or Generic ID: HYDROCARBON

Company	Telephone Numbers	
The Valvoline Company	Emergency:	1-800-274-5263
P.O. Box 14000		
Lexington, KY 40512	Information:	1-859-357-7206

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2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient(s)	CAS Number	% (by weight)
ALIPHATIC & AROMATIC HYDROCARBONS	68476-34-6	100.0

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3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye

May cause mild eye irritation.

Skin

May cause mild skin irritation. Prolonged or repeated contact may dry and crack the skin. Passage of this material into the body through the skin is possible, but it is unlikely that this would result in harmful effects during safe handling and use.

Swallowing

Swallowing small amounts of this material during normal handling is not likely to cause harmful effects. This material can get into the lungs during swallowing or vomiting. This results in lung inflammation and other lung injury.

Inhalation

It is possible to breathe this material under certain conditions of handling and use (for example, during heating, spraying, or stirring). Breathing small amounts of this material during normal handling is not likely to cause harmful effects. Breathing large amounts may be harmful.

Symptoms of Exposure

Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may include: stomach or intestinal upset (nausea, vomiting, diarrhea) irritation (nose, throat, airways), central nervous system depression (dizziness, drowsiness, weakness, fatigue, nausea, headache, unconsciousness), loss of coordination, liver damage.

Target Organ Effects

Exposure to this material (or a component) has been found to cause kidney damage in male rats. The mechanism by which this toxicity occurs is specific to the male rat and the kidney effects are not expected to occur in humans. Overexposure to this material (or its components) has been suggested as a cause of the following effects in laboratory animals, and may aggravate preexisting disorders of these organs in humans: anemia, lung damage.

Developmental Information

Based on the available information, risk to the fetus from maternal exposure to this material cannot be assessed.

Cancer Information

Diesel engine exhaust is listed as carcinogenic by the International Agency for Research on Cancer (IARC). Excess lung and bladder cancers have been reported in workers exposed to these emissions. In addition, exposure to diesel exhaust particulates is listed as carcinogenic by the National Toxicology Program. This product (or a component) is a petroleum-derived material. Similar materials and certain compounds occurring naturally in petroleum oils have been shown to cause skin cancer in laboratory animals following repeated exposure without washing or removal.

Other Health Effects

No data

Primary Route(s) of Entry

Inhalation, Skin absorption, Skin contact, Eye contact, Ingestion.

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4. FIRST AID MEASURES

Eyes

If symptoms develop, move individual away from exposure and into fresh air. Flush eyes gently with water while holding eyelids apart. If symptoms persist or there is any visual difficulty, seek medical attention.

Skin

Remove contaminated clothing. Wash exposed area with soap and water. If symptoms persist, seek medical attention. Launder clothing before reuse.

Swallowing

Seek medical attention. If individual is drowsy or unconscious, do not give anything by mouth; place individual on the left side with the head down. Contact a physician, medical facility, or poison control center for advice about whether to induce vomiting. If possible, do not leave individual unattended.

Inhalation

If symptoms develop, move individual away from exposure and into fresh air. If symptoms persist, seek medical attention. If breathing is difficult, administer oxygen. Keep person warm and quiet; seek immediate medical attention.

Note to Physicians

This material is an aspiration hazard. Potential danger from aspiration must be weighed against possible oral toxicity (See Section 3 - Swallowing) when deciding whether to induce vomiting. Preexisting disorders of the following organs (or organ systems) may be aggravated by exposure to this material: skin, lung (for example, asthma-like conditions), liver, Exposure to this material may aggravate any pre-existing condition sensitive to a decrease in available oxygen, such as chronic lung disease, coronary artery disease or anemias.

---

5. FIRE FIGHTING MEASURES

Flash Point

> 135.0 F (57.2 C)

Explosive Limit

No data

Autoignition Temperature

No data

Hazardous Products of Combustion

May form: carbon dioxide and carbon monoxide, various hydrocarbons.

Fire and Explosion Hazards

Vapors are heavier than air and may travel along the ground or be moved by ventilation and ignited by heat, pilot lights, other flames and ignition sources at locations distant from material handling point. Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively.

Extinguishing Media

regular foam, carbon dioxide, dry chemical.

Fire Fighting Instructions

Water or foam may cause frothing which can be violent and possibly endanger the life of the firefighter. Wear a self-contained breathing apparatus with a full facepiece operated in the positive pressure demand mode with appropriate turn-out gear and chemical resistant personal protective equipment. Refer to the personal protective equipment section of this MSDS.

NFPA Rating

Health - 1, Flammability - 2, Reactivity - 0

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6. ACCIDENTAL RELEASE MEASURES

Small Spill

Eliminate all sources of ignition such as flares, flames (including pilot lights), and electrical sparks. Absorb liquid on vermiculite, floor absorbent or other absorbent material.

Large Spill

Eliminate all ignition sources(flares, flames, including pilot lights, electrical sparks). Persons not wearing protectivve equipment should be excluded from the area of the spill until clean-up has been completed. Contain spill to the smallest area possible. Dike area to prevent spreading. Prevent from entering drains, sewers, streams or other bodies of water. Recover as much of the product as possible by methods such as vacuuming and use of absorbant. Transfer contaminated absorbent, soil and other materials in proper containers for ultimate disposal.

7. HANDLING AND STORAGE

Handling

Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in the data sheet must be observed. All five gallon pails and larger metal containers including tank cars and tank trucks should be grounded and/or bonded when material is transferred.

Storage

Not applicable

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Eye Protection

Chemical splash goggles in compliance with OSHA regulations are advised; however, OSHA regulations also permit other type safety glasses. Consult your safety representative.

Skin Protection

Wear resistant gloves such as: neoprene, nitrile rubber, To prevent repeated or prolonged skin contact, wear impervious clothing and boots.

Respiratory Protections

If workplace exposure limit(s) of product or any component is exceeded (See Exposure Guidelines), a NIOSH/MSHA approved air supplied respirator is advised in absence of proper environmental control. OSHA regulations also permit other NIOSH/MSHA respirators (negative pressure type) under specified conditions (consult your industrial hygienist). Engineering or administrative controls should be implemented to reduce exposure.

Engineering Controls

Provide sufficient mechanical (general and/or local exhaust) ventilation to maintain exposure below TLV(s).

Exposure Guidelines
Component

ALIPHATIC & AROMATIC HYDROCARBONS (68476-34-6)
No exposure limits established

9. PHYSICAL AND CHEMICAL PROPERTIES

Boiling Point

(for product) 320.0 - 400.0 F (160.0 - 204.4 C) @ 760.00 mmHg

Vapor Pressure

(for product) < 1.000 mmHg @ 68.00 F

Specific Vapor Density

> 5.000 @ AIR=1

Specific Gravity
    .876 @ 60.00 F

Liquid Density
    7.296 lbs/gal @ 60.00 F
    .876 kg/l @ 15.60 C

Percent Volatiles (Including Water)
    No data

Evaporation Rate
    SLOWER THAN ETHYL ETHER

Appearance
    No data

State
    LIQUID

Physical Form
    HOMOGENEOUS SOLUTION

Color
    RED, DYED LIQUID

Odor
    No data

pH
    Not applicable

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10. STABILITY AND REACTIVITY

Hazardous Polymerization
    Product will not undergo hazardous polymerization.

Hazardous Decomposition
    May form: carbon dioxide and carbon monoxide, various hydrocarbons.

Chemical Stability
    Stable.

Incompatibility
    Avoid contact with: strong oxidizing agents.

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11. TOXICOLOGICAL INFORMATION

Mutagenicity
    This material (or a component) caused mutations in cells in culture and in laboratory animals. The relevance of this finding to human health is uncertain.

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12. ECOLOGICAL INFORMATION

    No data

13. DISPOSAL CONSIDERATION

Waste Management Information

Dispose of in accordance with all applicable local, state and federal regulations.

14. TRANSPORT INFORMATION

DOT Information - 49 CFR 172.101

DOT Description:

Not Regulated

Container/Mode:

No data

NOS Component:

None

RQ (Reportable Quantity) - 49 CFR 172.101

Not applicable

15. REGULATORY INFORMATION

US Federal Regulations

TSCA (Toxic Substances Control Act) Status

TSCA (UNITED STATES) The intentional ingredients of this product are listed.

CERCLA RQ - 40 CFR 302.4

None

SARA 302 Components - 40 CFR 355 Appendix A

None

Section 311/312 Hazard Class - 40 CFR 370.2

Immediate(X) Delayed(X) Fire(X) Reactive( ) Sudden Release of Pressure( )

SARA 313 Components - 40 CFR 372.65

None

International Regulations

Inventory Status

AICS (AUSTRALIA) The intentional ingredients of this product are listed.

DSL (CANADA) The intentional ingredients of this product are listed.

ECL (SOUTH KOREA) The intentional ingredients of this product are listed.

EINECS (EUROPE) The intentional ingredients of this product are listed.

ENCS (JAPAN) The intentional ingredients of this product are listed.

State and Local Regulations

California Proposition 65

None

16. OTHER INFORMATION

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

End of data

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*** IDENTIFICATION ***

MSDS RECORD NUMBER : 503384
PRODUCT NAME(S): General Triplex Dry Chemical

*** 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

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 - Monoammonium
Phosphate Base Contains No Hazardous Ingredients

Section III - Physical/Chemical Characteristics

Boiling Point NA
Specific Gravity (H2O = 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 repellant. 94% soluble.
Appearance and Odor Fine yellow Powder

Section IV - Fire and Explosion Hazard Data
Flash Point (Method Used) NA

Flammable Limits NA
LEL NA
UEL NA
Extinguishing Media NA - Fire Extinguishing agent
Special Fire Fighting Procedures
Unusual Fire and Explosion Hazards

Section V - Reactivity Data
Stability Unstable [ ] Conditions to Avoid
Stable [X]

Incompatibility (Materials to Avoid)
Do not mix with bicarbonate base fire extinguishing agents.

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

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

Section VIII - Control Measures

Respiratory Protection (Specify Type)
Use particle mask, 3M 8500 Non-Toxic, when handling
Ventilation
Local Exhaust   Special
Use to remove dust
Mechanical (General)   Other

Protective Gloves   Not needed   Eye Protection   Not needed

Other Protective Clothing or Equipment   Not needed.

Work/Hygienic Practices
After handling, wash exposed skin with warm water and soap.

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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**

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.

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 - Sodium Bicarbonate Base.
Contains no hazardous ingredients.

Section III - Physical/Chemical Characteristics

Boiling Point   NA   Specific Gravity (H2O = 1)   2.16
Vapor Pressure (mm Hg.) NA   Melting Point   NA

Vapor Density (AIR = 1) NA Evaporation Rate NA
(Butyl Acetate = 1)
Solubility in Water Water repellant. 98% soluble
Appearance and Odor Fine white 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 sodium carbonate, carbon dioxide and water at high temperatures.

Hazardous May Occur [ ] Conditions to Avoid
Polymerization Will Not Occur [X]

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

Section VIII - Control Measures

Respiratory Protection (Specify Type)

Use particle mask, 3M 8500 Non-Toxic, when handling

Ventilation Local Exhaust Special

Use to remove dust

Mechanical (General) Other

Protective Gloves Not needed Eye Protection Not needed

Other Protective Clothing or Equipment Not needed.

Work/Hygienic Practices

After handling, wash exposed skin with warm water and soap.

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*                  M S D S                  *
*                                           *
*  Canadian Centre for Occupational Health and Safety   *
* * * * * * * * * * * * * Issue : 94-4 (November, 1994) *
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*** 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

Boiling Point NA Specific Gravity (H2O = 1) 2.17
Vapor Pressure (mm Hg.) NA Melting Point NA

Vapor Density (AIR = 1) NA   Evaporation Rate   NA
(Butyl Acetate = 1)
Solubility in Water   Water repellant. 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   May Occur [ ]   Conditions to Avoid
Polymerization   Will Not Occur [X]

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

Section VIII - Control Measures

Respiratory Protection (Specify Type)
Use particle mask 3M 8506 Non-Toxic, when handling.
Ventilation Local Exhaust Special
Use to remove dust.
Mechanical (General) Other

Protective Gloves Not needed Eye Protection Not needed

Other Protective Clothing or Equipment Not needed.

Work/Hygienic Practices
After handling, wash exposed skin with warm water and soap.

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*                    M S D S                    *
*                                            *
*  Canadian Centre for Occupational Health and Safety   *
* * * * * * * * * * * * * Issue : 94-4 (November, 1994) *
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***** 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 reuqirements. 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 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

Section IV - Fire and Explosion Hazard Data schema feu & explosion hazard

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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

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

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.

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-dimethyl cyclopropanecarboxylate 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 crystalizes 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) disturbances such as nausea, vomiting, irritable behaviour, tremors and muscle weakness might

EXPOSURE : INHALATION : One study reported 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 occur.

CARCINOGENICITY : No information available
TERATOGENICITY AND EMBRYOTOXICITY : No human information available. No teratogenic or embryotoxic effects in mice.
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 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 and/or the nearest Poison Control Center for all 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 :

procedures
appropriate for the product as a whole.

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 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 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 information is available. Contact manufacturer/supplier for advice. Polyvinyl alcohol (PVA) provides good resistance to pyrethrins and 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 x 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

INCOMPATIBILITY - MATERIALS TO AVOID : STRONG OXIDIZING AGENTS - May increase 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

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.

*** 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

*** MATERIAL SAFETY DATA ***

PRIMARY APPLICATION- MOTOR FUEL

SYNONYMS...... : UNLEADED PREMIUM GASOLINE
CAS REGISTRY NO: SEE SEC. 2
CAS NAME...... : NO CLASSIFICATION - MIXTURE
CHEMICAL FAMILY: MOTOR FUEL.

EMERGENCY PHONE NUMBERS (AFTER NORMAL BUSINESS HOURS)
CHEMTREC. 1-800-424-9300

2. COMPOSITION / INFORMATION ON INGREDIENTS

EXPOSURE GUIDELINES

	OSHA	ACGIH							
COMPONENT/CAS NO.	LO%	HI%	TWA	STEL	TWA	STEL	TWA	STEL	UNIT
LIMITS FOR THE PRODUCT:									
			300	500	300	500			PPM
XYLENE									
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 & 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.

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

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

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 % 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. WEARSTRUCTURAL 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 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
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 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 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.
LAUNDER 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)
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
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 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.
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.

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 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.

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. 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, 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, 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 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. PROLONGED EXPOSURES CAUSE HARM TO THE CENTRAL NERVOUS SYSTEM PRODUCING A LACK OF FEELING IN EXTREMITIES (HANDS AND FEET) AND MORE SEVEE NERVE DAMAGE (PERIPHERAL NEUROPATHY).

NAPHTHALENE (COMPONENT)
INHALATION: VAPORS MAY CAUSE RESPIRATORY TRACT IRRITATION, HEADACHE, CONFUSION, EXCITEMENT, PROFUSE SWEATING, ABDOMINAL PAIN, VOMITING, DIARRHEA.

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 &

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 SIMILIAR 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 SYTEM (BRAIN) EFFECTS, NARCOTIC EFFECTS, NAUSEA, HEADACHE, DIZZINESS, INCOORDINATION, UNCONSCIOUSNESS, COMA, DEATH.

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. CONTRACT 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

SARA 302 THRESHOLD PLANNING QUANTITY. N/A

SARA 304 REPORTABLE QUANTITY .... 204 POUNDS

SARA 311 CATEGORIES- IMMEDIATE (ACUTE) HEALTH EFFECTS.. Y
DELAYED (CHRONIC) HEALTH EFFECTS.. Y
FIRE HAZARD .... Y
SUDDEN RELEASE OF PRESSURE HAZARD. N

REACTIVITY HAZARD .... N

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 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.

APPENDIX E - ATTACHMENT 7. SAFETY FORMS

This attachment contains the following safety forms for this project:

- Accident Investigation Report
- Contractor Significant Incident Report (CSIR-1)
- Employee Injury Report
- Heat Stress Alert Checklist
- Heat Stress Field Monitoring Log
- Record of Safety Violation or Non-Compliance
- Safety Inspection Report
- Safety Meeting/Training Form
- Site Visitor Log
- Tailgate Safety Briefing.

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For Safety Staff Only	Report No.	EROC Code	**UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT** (For use of this form, see help menu and USACE supplement to AR 385-40)	Requirement Control Symbol: CEEC-S-8-(R2)

1. ACCIDENT CLASSIFICATION

Personnel Classification	Injury/Illness/Fatal	Property Damage	Motor Vehicle Involved	Diving
Government ☐ Civilian ☐ Military	☐	☐ Fire Involved ☐ Other	☐	☐
☐ Contractor	☐	☐ Fire Involved ☐ Other	☐	☐
☐ Public	☐ Fatal ☐ Other		☐	

2. PERSONAL DATA

a. Name (Last, First, MI)	b. Age	c. Sex ☐ Male ☐ Female	d. Social Security Number	e. Grade
f. Job Series/Title	g. Duty Status at Time of Accident ☐ On Duty ☐ TDY ☐ Off Duty		h. Employment Status at Time of Accident ☐ Army Active ☐ Army Reserve ☐ Volunteer ☐ Permanent ☐ Foreign National ☐ Seasonal ☐ Temporary ☐ Student ☐ Other (specify)	

3. GENERAL INFORMATION

a. Date of Accident (month/day/year)	b. Time of Accident (military time) hrs	c. Exact Location of Accident	d. Contractor's Name 1) Prime: 2) Subcontractor:
e. Contract Number ☐ Civil Works ☐ Military ☐ Other (specify)	f. Type of Contract ☐ Construction ☐ Service ☐ A/E ☐ Dredge ☐ Other (specify)	g. Hazardous/Toxic Waste Activity ☐ SuperFund ☐ DERP ☐ IRP ☐ Other (specify)	

4. CONSTRUCTION ACTIVITIES ONLY (Fill in time and corresponding code number in box from list – see help menu)

a. Construction Activity Code #	b. Type of Construction Equipment Code #

5. INJURY/ILLNESS INFORMATION (Include name and corresponding code number in box for items e, f, g – see help menu)

a. Severity of Illness/Injury Code #	b. Estimated Days Lost	c. Estimated Days Hospitalized	d. Estimated Days Restricted Duty
e. Body Part Affected Primary Code # Secondary Code #	g. Type and Source of Injury/Illness Type Code # Source Code #		
f. Nature of Illness/Injury Code #			

6. PUBLIC FATALITY (Fill in line and corresponding code number in box – see help menu)

a. Activity at Time of Accident Code #	b. Personal Flotation Device Used? ☐ Yes ☐ No ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. Type of Vehicle	b. Type of Collision	c. Seat Belts	Used	Not Used	Not Available
☐ Pickup/Van ☐ Truck ☐ Automobile ☐ Other (specify)	☐ Side Swipe ☐ Head On ☐ Rear End ☐ Broadside ☐ Roll Over ☐ Backing ☐ Other (specify)	1) Front Seat ☐ 2) Rear Seat ☐			

8. PROPERTY/MATERIAL INVOLVED

a. Name of Item	b. Ownership	c. $ Amount of Damage
1)		
2)		
3)		

9. VESSEL/FLOATING PLANT ACCIDENT (Fill in line and corresponding code number in box from list – see help menu)

a. Type of Vessel/Floating Plant Code #	b. Type of Collision/Mishap Code #

10. ACCIDENT DESCRIPTION (Use additional paper, if necessary)

11.	**CAUSAL FACTOR(S)** (Read instructions before completing)				
a. (ExplainYES answers in item 13)	YES	NO	(Continued)	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐	CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents such as dust, fumes, mists, vapors or physical agents, such as noise, radiation, etc., contribute to the accident?	☐	☐
INSPECTION/MAINTENANCE: Were inspection and maintenance procedures a factor?	☐	☐	OFFICE FACTORS: Did office settings such as lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐	SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐	DRUGS/ALCOHOL: In your opinion, were drugs or alcohol factor in the accident?	☐	☐
JOB PRACTICIES: Were any job safety/health practices not followed when the accident occurred?	☐	☐	b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?		
HUMAN FACOTRS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐	☐ YES (If yes, attach a copy) ☐ NO		
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐			

12.	**TRAINING**	
a. Was Person Trained to Perform Activity/Task? ☐ Yes ☐ No	b. Type of Training. ☐ Classroom ☐ On Job	c. Date of Most Recent Formal Training. (month/day/year)

13. Fully explain what allowed or caused the accident, include direct and indirect causes. (See instruction for definition of direct and indirect causes.)

a. Direct Cause

b. Indirect Cause(s)

14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).

Describe fully:

15.	**DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.**		
a. Beginning (month/day/year)		b. Anticipated Completion (month/day/year)	
c. Signature and Title of Supervisor completing Report Corps Contractor	d. Date (month/day/year)	Organization Identifier (Div/Branch/Sect)	f. Office Symbol

16. MANAGEMENT REVIEW

a. ☐ Concur b. ☐ Non- Concur c. ☐ Comments

Signature	Title	Date

17. MANAGEMENT REVIEW (2nd – Chief Operations, Construction, Engineering, etc.)

a. ☐ Concur b. ☐ Non- Concur c. ☐ Comments

Signature	Title	Date

18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW

a. ☐ Concur b. ☐ Non- Concur c. ☐ Additional Actions/Comments

Signature	Title	Date

19. COMMAND APPROVAL

Comments

Commander Signature	Date

10.	**ACCIDENT DESCRIPTION** (Continuation)
13 a.	**DIRECT CAUSE** (Continuation)
13 b.	**INDIRECT CAUSES** (Continuation)
14.	**ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S)** (Continuation)

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☐ Initial Report
☐ Follow-up Report
☐ Final Report

Contractor Significant Incident Report (CSIR)

1. General Information

Contracting Activity/ROICC Office:

Accident Classification:

☐ Injury ☐ Fatality ☐ Environment ☐ Procedural Issues ☐ Lessons Learned

☐ Illness ☐ Property Damage ☐ Other_______________________________

Involving:

☐ Confined Space ☐ Equip/Mrt Ver/Mat Handling (Heavy Construction Equip.) ☐ Hazardous Material

☐ Crane and Rigging ☐ Equip/Mrt Ver/Mat Handling (Material Handling) ☐ Trenching/Excavation

☐ Diving ☐ Equip/Mrt Ver/Mat Handling (Man-Lift/Elevated Platform) ☐ Waterfront/Marine Operations

☐ Demolition/Renovation ☐ Fall from Ladder ☐ Fall from Scaffold ☐ Other___________________

☐ Electrical ☐ Fall from Roof ☐ Fire

2. Personal Information

Name (Last, First, MI):	**Age:**	**Sex:**

Job Title/Description:	**Employed By:**
Supervisor Name (Last, First, MI) & Title:	**Was the person trained to perform this activity/task?** ☐ **Yes** ☐ **No**
What type of training was received (OJT, classroom, etc)?	**Date of the most recent formal training and topics discussed?**

3. Witness Information

Witness #1: Name (Last, First, MI):	**Job Title/Description:**
Employed By:	**Supervisor Name (Last, First, MI):**
Witness #2: Name (Last, First, MI):	**Job Title/Description:**
Employed By:	**Supervisor Name (Last, First, MI):**

Additional Witnesses: ☐ **Yes** ☐ **No**
(List any additional witnesses on a separate sheet and attach.)

4. Contract Information

Type of Contract:

☐ A/E ☐ BOS ☐ CLEAN ☐ Construction ☐ Design Build ☐ FSCC ☐ FSSC

☐ JOC ☐ RAC ☐ Service ☐ Other______________________________

Contract Number & Title:	**Industrial Group & Industrial Type:**
Prime Contractor Name/Address/Phone & Fax No: **Safety Manager (Last, First, MI):** **Insurance Carrier:**	**Sub Contractor Name/Address/Phone & FAX No:** **Safety Manager (Last, First, MI):** **Insurance Carrier:**

5. Accident Description

Date of Accident:	**Time of Accident:**	**Exact Location of Accident:**

Describe the accident in detail in your words: ***(Use the back of page if you need additional space)***

Direct Cause(s) of Accident:

Indirect Cause(s) of Accident:
Action(s) taken to prevent re-occurrence or provide on-going corrective actions:

Corrective Action Beginning Date:	**Anticipated Completion Date:**

Personal Protective Equipment:

☐ Available and used ☐ Available and not used ☐ Not Required

☐ Not related to Mishap ☐ Wrong PPE for job

List PPE Used:

Type of Construction Equipment (Make, Model, Serial #, VIN#) Involved:

Was Hazardous Material Spilled/Released? ☐ **Yes** ☐ **No**

Please List Hazardous Material(s) Involved:

Who provided first aid or cleanup of mishap site?

Any blood-borne pathogen exposure, other than EMTs? ☐ **Yes** ☐ **No**

Who?

List OSHA and EM-385-1-1 standards that were violated:

Was site secured and witness statements taken immediately? ☐ **Yes** ☐ **No**

By Whom?

6. Injury Illness/Fatality Information

Severity of Injury/Illness:

☐ Fatality	☐ Lost Workday Case Involving Days Away From Work	
☐ Temporary Disabillity	☐ Recordable Workday Case Involving Restricted Duty	
☐ Permanent Total Disability	☐ Other Recordable Case	☐ Recordable First Aid Case
☐ Permanent Partial Disability	☐ Non-Recordable Case	☐ No Injury

Estimated Days Lost:	**Estimated Days Hospitalized:**	**Estimated Days Restricted Duty:**
List Primary Body Part Affected:	**List Other Body Part(s) Affected:**	

Nature of Injury/Illness for Primary Body Part (Examples: Amputation, Burn, Hernia):

Type of Accident (Examples: Fall same level, Lifting, Bitten, Exerted):

Source of Accident (Examples: Crane, Carbon Monoxide, Ladder, Welding Equipment):

7. Causal Factors *(Explain answers on supplementary sheet)*

• **Design – Design of facility, workplace, or equipment was a factor?**	☐ **Yes** ☐ **No**
• **Inspection/Maintenance – Inspection & Maintenance procedures were a factor?**	☐ **Yes** ☐ **No**
• **Persons Physical Condition – In your opinion, the physical condition of the person was a factor?**	☐ **Yes** ☐ **No**
• **Operation Procedures – Operating procedures were a factor?**	☐ **Yes** ☐ **No**
• **Job Practices – One or more job safety/health practices not being followed when the accident occurred contributed to the accident?**	☐ **Yes** ☐ **No**
• **Human Factors – One or more human factors, such as a person's size or strength contributed to the accident?**	☐ **Yes** ☐ **No**
• **Environmental Factors – Heat, cold, dust, sun, glare, etc., contributed to the accident?**	☐ **Yes** ☐ **No**
• **Chemical and Physical Agent Factors – Exposure to chemical agents, such as dust, fumes, mist, vapors, or physical agents such as noise, radiation, etc., contributed to the accident?**	☐ **Yes** ☐ **No**
• **Office Factors – Office setting such as lifting office furniture, carrying, stooping, contributed to the accident?**	☐ **Yes** ☐ **No**
• **Support Factors – Inappropriate tools/resources were provided to perform the task?**	☐ **Yes** ☐ **No**
• **PPE – Improper selection, use or maintenance of PPE contributed to the accident?**	☐ **Yes** ☐ **No**
• **Drugs/Alcohol – In your opinion, were drugs or alcohol a factor?**	☐ **Yes** ☐ **No**
• **Job Hazard Analysis – The lack of an adequate (IAW-EM-385-1-1 Sec 01.A) activity hazard analysis was a contributing factor.**	☐ **Yes** ☐ **No**
• **Job Hazard Analysis – JHA was not site specific and/or did not address the type of work/operations performed when the mishap occurred.**	☐ **Yes** ☐ **No**
• **Management – A lack of adequate supervision contributed to the accident.**	☐ **Yes** ☐ **No**
• **Management – Inadequate information was provided at pre con meeting.**	☐ **Yes** ☐ **No**

8. OSHA Information			
Date OSHA was Notified:	**Date(s) of Investigation:**	**Date of citation:** ***(Attach Copy)***	**Dollar amount of Penalties:**

9. Report Preparer	
Name (Last, First, MI):	**Date of Report:**
Title: **Employer:** **Phone #:**	**Signature:**

CONTRACTOR SIGNIFICANT INCIDENT REPORT (CSIR) INSTRUCTIONS
Complete Sections Appropriate to Incident (Rev. 06/02).

NOTE: THE ATTACHED CSIR FORM IS TO BE USED BY CONTRACTORS TO RECORD THE RESULTS OF THEIR ACCIDENT/INCIDENTS INVESTIGATIONS AND SHALL BE PROVIDED TO THE CONTRACTING OFFICER WITHIN THE REQUIRED TIMEFRAMES.

GENERAL. Complete a separate report for each person who was injured in the accident. A report needs to be completed for all OSHA recordable accidents, property damage in excess of $2000.00 (This amount is for record purposes only. GOV is not required to enter property damage reports into FAIR database if it is less than $10,000.00.), WHE accidents, or near miss/high visibility mishaps. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es), non-applicable sections shall be marked "N/A". If additional space is needed, provide the information on a separate sheet of paper and attach to the completed form.

Mark the report:
INITIAL – If this form is being used as initial notification of a Fatality or High Visibility Mishap. The initial form is due within 4 hours of a serious accident. A form marked 'Follow-up' or 'Final' is required within 5 days.
FOLLOW-UP – If you are providing additional information on a report previously submitted.
FINAL – If you are providing a completed report and expect no changes.

SECTION 1 – GENERAL INFORMATION

CONTRACTING ACTIVITY/ROICC OFFICE - Enter the name and address of the Contracting Office administering the contract under which the mishap took place (e.g. ROICC MCBH, ROICC NORFOLK, PWC GUAM, etc.).

ACCIDENT CLASSIFICATION - INJURY/ILLNESS/FATALITY/PROPERTY DAMAGE/-PROCEDURAL ISSUES/-ENVIRONMENTAL/LESSONS LEARNED/OTHER – Mark the appropriate block(s) if the incident resulted in any of these conditions.

INVOLVING - If the mishap involved any of the conditions listed under "Involving" mark the appropriate box(es). Specific questions associated with each of these conditions are available from the Contracting Officer to assist you in your investigation. When these questions are used they shall be attached as part of this report.

SECTION 2 - PERSONAL INFORMATION

NAME - Enter last name, first name, middle initial of person involved.
AGE - Enter age.
SEX - Enter M for Male and F for Female.
JOB TITLE/DESCRIPTION - Enter the job title/description assigned to the injured person (e.g. carpenter, laborer, surveyor, etc.).
EMPLOYED BY - Enter employment company name of the person involved.
SUPERVISOR'S NAME & TITLE - Enter name and title of the immediate supervisor.
WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? - For the purpose of this section "trained" means the person has been provided the necessary information (either formal and/or on-the-job (OJT) training) to competently perform the activity/task in a safe and healthful manner.
TYPE OF TRAINING - Indicate the specific type of training (classroom or on-the-job) that the injured person received before the accident happened.
DATE OF MOST RECENT FORMAL TRAINING/TOPICS DISCUSSED - Enter the month, day, and year of the last *formal* training completed that covered the activity/task being performed at the time of the accident. List topics that were discussed at the training identified above.

SECTION 3 - WITNESS INFORMATION

The following applies to Witness #1 and Witness #2:
WITNESS NAME - Enter last name, first name, middle initial of the witness.
JOB DESCRIPTION/TITLE - Enter the job title/description assigned to the witness (e.g. carpenter, laborer, surveyor, etc.).
EMPLOYED BY - Enter the name of the employment company of the witness.
SUPERVISORS NAME - Enter name of immediate supervisor of the witness.
ADDITIONAL WITNESSES - Provide same information, as above, for each witnesses. Use additional pages if necessary.

SECTION 4 - CONTRACTOR INFORMATION

TYPE OF CONTRACT - Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.
CONTRACT NUMBER/TITLE - Enter complete contract number and tile of prime contract (e.g. N62477-85-C-0100, 184 Pearl City Hsg. Revitalization).
CONSTRUCTION INDUSTRIAL GROUP AND INDUSTRIAL TYPE – This is the type of construction that will be done at this project.

1. First, you must choose the Industrial Group. You have 4 choices to choose from: (**NOTE**! Review of the Industrial Types below and knowing what the projects scope of work is will assist you in deciding what the Industrial Group should be.)

a. Buildings
b. Heavy Industrial
c. Infrastructure
d. Light Industrial

2. Once you have chosen the Industrial Group, you now select the Industrial Type. You have multiple choices under each Group, chose the one you feel fits the project most closely because on most projects there won't be an exact match:

a. Buildings:
   (1) Communications Ctr.
   (2) Dormitory/Hotel
   (3) High-rise Office
   (4) Hospital
   (5) Housing
   (6) Laboratory
   (7) Low-rise Office
   (8) Maintenance Facility
   (9) Parking Garage
   (10) Physical Fitness Ctr.
   (11) Restaurant/Nightclub
   (12) School
   (13) Warehouse
b. Heavy Industrial:
   (1) Chemical Mfg.
   (2) Electrical (Generating)
   (3) Environmental
   (4) Metals Refining/Processing
   (5) Mining
   (6) Natural Gas Processing
   (7) Oil Exploration/Production
   (8) Oil Refining
   (9) Pulp and Paper
c. Infrastructure:
   (1) Airport
   (2) Electrical Distribution
   (3) Flood Control
   (4) Highway
   (5) Marine Facilities
   (6) Navigation
   (7) Rail
   (8) Tunneling
   (9) Water/Wastewater
d. Light Industrial:
   (1) Automotive Assembly/Mfg.
   (2) Consumer Products Mfg.
   (3) Foods
   (4) Microelectronics Mfg.
   (5) Office Products Mfg.
   (6) Pharmaceuticals Mfg.

CONTRACTOR'S NAME/ADDRESS/PHONE NUMBER
(1) PRIME - Enter the exact name (title of firm), address, phone and fax numbers of the prime contractor.
(2) SUBCONTRACTOR - Enter the exact name, address, phone and fax numbers of any subcontractor involved in the accident.

SAFETY MANAGER'S NAME
(1) PRIME - Enter the name of the prime contractor safety manager.
(2) SUBCONTRACTOR - Enter the name of the subcontractors safety manager.

INSURANCE CARRIER
(1) PRIME - Enter the exact name/title of the prime's insurance company. Policy number not required.
(2) SUBCONTRACTOR - Enter the exact name of the subcontractor's insurance company. Policy number not required.

SECTION 5 - ACCIDENT DESCRIPTION

DATE OF ACCIDENT - Enter the month, day, and year of accident.
TIME OF ACCIDENT - Enter the local time of accident in military time. Example: 14:30 hrs (not 2:30 p.m.).
EXACT LOCATION OF ACCIDENT - Enter facts needed to locate the accident scene (installation/project name, building/room number, street, direction and distance from closest landmark, etc.).
DESCRIBE THE ACCIDENT IN DETAIL. Fully describe the accident in the space provided. If property damage involved, give estimated dollar amount of damage and/or repair costs involved. If additional space is needed continue on a separate sheet and attach to this report. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role(s) in the accident. Ensure that relationships between personnel and equipment are clearly specified. Ensure questions below regarding direct cause(s), indirect cause(s), and actions taken are answered. **NOTE!** Review questions in Section 7 below before completing.
DIRECT CAUSE(S) - The direct cause is that single factor which most directly lead to the accident. See examples below.
INDIRECT CAUSE(S) - Indirect cause are those factors, which contributed to, but did not directly initiate the occurrence of the accident.

Examples for Direct and Indirect Cause:
1. Employee was dismantling scaffold and fell 12 feet from unguarded opening.
Direct cause: Failure to provide fall protection at elevation

Indirect causes: Failure to enforce safety requirements: improper training/motivation of employee (possibility that employee was not knowledgeable of fall protection requirements or was lax in his attitude toward safety); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

2. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by contractor vehicle. (note contractor vehicles was in proper safe working condition.)
Direct cause: Failure of contractor driver to maintain control of and stop contractor vehicle within safe distance.
Indirect cause: Failure of employee to pay attention to driving (defensive driving).

ACTION(S) TAKEN TO PREVENT RE-OCCURRENCE OR PROVIDE ON-GOING CORRECTIVE ACTIONS. Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on back or additional sheets of paper if necessary to fully explain and attach to the complete report form.
CORRECTIVE ACTION DATES -
(1) Beginning - Enter the date when the corrective action(s) identified above will begin.
(2) Anticipated Completion - Enter the date when the corrective action(s) identified above will be completed.
PERSONAL PROTECTIVE EQUIPMENT (PPE) - Mark appropriate box(es) and list PPE which was being used by the injured person at the time of the accident (e.g. protective clothing, shoes, glasses, goggles, respirator, safety belt, harness, etc.)
TYPE OF CONTRACTOR EQUIPMENT - Enter the Serial Number, Model Number and specific type of equipment involved in the mishap (e.g. dump truck (off highway), crane (rubber tire), pump truck (concrete), etc.).
WAS HAZARDOUS MATERIAL SPILLED/RELEASED? - Mark appropriate block and list name(s) of any reportable quantities of hazardous materials spilled/released during the mishap.
WHO PROVIDED FIRST AID OR CLEAN-UP OF MISHAP SITE? - List name(s) of individual(s) and employer, if known.
ANY BLOOD-BORNE PATHOGEN EXPOSURE, OTHER THAN EMT? - Mark appropriate block and list name(s) of individual(s) and employer, if known.
LIST OSHA AND/OR EM 385-1-1 STANDARDS THAT WERE VIOLATED. - Self explanatory.
WAS SITE SECURED AND WITNESS STATEMENT TAKEN IMMEDIATELY? - Mark appropriate block and list by whom.

SECTION 6 - INJURY/ILLNESS/FATALITY INFORMATION

SERVERITY OF INJURY/ILLNESS – Mark appropriate box.
ESTIMATED DAYS LOST - Enter the estimated number of workdays the person will lose from work. Update when final data is known.
ESTIMATED DAYS HOSPITALIZED - Enter the estimated number of workdays the person will be hospitalized. Update when final data is known.
ESTIMATED DAYS RESTRICTED DUTY - Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties. Update when final data is known.
BODY PART(S) AFFECTED - Enter the most appropriate primary and when applicable, secondary, etc. body part(s) affected (e.g. arm: wrist: abdomen: single eye; jaw : both elbows: second finger: great toe: collar bone: kidney, etc.).
NATURE OF INJURY/ILLNESS FOR PRIMARY BODY PART - Enter the most appropriate nature of injury/illness (e.g. amputation, back strain, dislocation, laceration, strain, asbestosis, food poisoning, heart conditions, etc.).
TYPE AND SOURCE OF INJURY/ILLNESS - Type and Source Codes are used to describe what caused the incident.
(1) TYPE Code stands for an "Action" (Example: Worker, installing conduit, lost his balance and fell five feet from a ladder. Type Code: Fell different levels".) Select the most appropriate Type of injury from the list below:

TYPE OF INJURY/ILLNESS

STRUCK BY/AGAINST	CONTACTED CONTACTED WITH (INJURED PERSON MOVING) CONTACTED BY (OBJECT WAS MOVING)
FELL, SLIPPED, TRIPPED SAME LEVEL/DIFFERENT LEVEL/NO FALL	EXERTED LIFTED, STRAINED BY (SINGLE ACTION) STRESSED BY (REPEATED ACTION)
CAUGHT ON/IN/BETWEEN	EXPOSED INHALED/INGESTED/ABSORBED/EXPOSED TO
PUNCTURED, LACERATED PUNCTURED BY/CUT BY/STUNG BY/BITTEN BY	TRAVELING IN

(2) SOURCE Code stands for an "object or substance." (Example: Worker, installing conduit, lost his balance and fell five feet from a ladder. Source Code: "Ladder".) Select the most appropriate Source of injury from the list below:

SOURCE OF INJURY/ILLNESS

BUILDING OR WORKING AREA WALKING/WORKING AREA STAIRS/STEPS LADDER FURNITURE BOILER/PRESSURE VESSEL EQUIPMENT LAYOUT WINDOWS/DOORS ELECTRICITY	DUST, VAPOR, ETC. DUST (SILICA, COAT, ETC.) FIBERS ASBESTOS GASES CARBON MONOXIDE MIST, STEAM, VAPOR, FUME WELDING FUMES PARTICLES (UNIDENTIFIED)

ENVIRONMENT CONDITION TEMPERATURE EXTREME (INDOOR) WEATHER (ICE, RAIN, HEAT, ETC.) **FIRE, FLAME, SMOTE (NOT TABACCO)** NOISE RADIATION LIGHT VENTILATION TOBACCO SMOKE STRESS (EMOTIONAL) CONFINED SPACE	CHEMICAL, PLASTIC, ETC. DRY CHEMICAL - CORROSIVE DRY CHEMICAL - TOXIC DRY CHEMICAL - EXPLOSIVE DRY CHEMICAL - FLAMMABLE LIQUID CHEMICAL - CORROSIVE LIQUID CHEMICAL - TOXIC LIQUID CHEMICAL - EXPLOSIVE LIQUID CHEMICAL - FLAMMABLE PLASTIC WATER MEDICINE
MACHINE OR TOOL HAND TOOL (POWERED: SAW, GRINDER, ETC.) HAND TOOL (NON POWERED) MECHANCIAL POWER TRANSMISSION APPARATUS GUARD, SHIELD (FIXED, MOVEABLE, INTERLOCK) VIDEO DISPLAY TERMINAL PUMP, COMPRESSOR, AIR PRESSURE TOOL HEATING EQUIPMENT WELDING EQUIPMENT	INANIMATE OBJECT BOX, BARREL, ETC. PAPER METAL ITEM, MINERAL NEEDLE GLASS SCRAP, TRASH, WOOD FOOD CLOTHING, APPAREL, SHOES
MACHINE OR TOOL HAND TOOL (POWERED: SAW, GRINDER, ETC.) HAND TOOL (NON POWERED) MECHANCIAL POWER TRANSMISSION APPARATUS GUARD, SHIELD (FIXED, MOVEABLE, INTERLOCK) VIDEO DISPLAY TERMINAL PUMP, COMPRESSOR, AIR PRESSURE TOOL HEATING EQUIPMENT WELDING EQUIPMENT	INANIMATE OBJECT BOX, BARREL, ETC. PAPER METAL ITEM, MINERAL NEEDLE GLASS SCRAP, TRASH, WOOD FOOD CLOTHING, APPAREL, SHOES
VEHICLE AS DRIVER OF PRIVATELY OWNED, RENTAL VEH. AS PASSENGER OF PRIVATELY OWNED, RENTAL VEH. DRIVER OF GOVERNMENT VEHICLE PASSENGER OF GOVERNMENT VEHICLE COMMON CARRIER (AIRLINE, BUS, ETC.) AIRCRAFT (NOT COMMERCIAL) BOAT, SHIP, BARGE	ANIMATE OBJECT DOG OTHER ANIMAL PLANT INSECT HUMAN (VIOLENCE) HUMAN (COMMUNICABLE DISEASE) BACTERIA, VIRUS (NOT HUMAN CONTACT)
MATERIAL HANDLING EQUIPMENT EARTHMOVER (TRACTOR, BACKHOE, ETC.) CONVEYOR (FOR MATERIAL AND EQUIPMENT) ELEVATOR, ESCALATOR, PERSONNEL HOIST HOIST, SLING CHAIN, JACK CRANE FORKLIFT HANDTRUCK , DOLLY	PERSONAL PROTECTIVE EQUIPMENT PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES RESPIRATOR, MASK DIVING EQUIPMENT SAFETY BELT, HARNESS PARACHUTE

SECTION 7 - CAUSAL FACTORS

Review thoroughly. Answer each question by marking the appropriate block. **NOTE!** If any answer is yes, explain in section 5 above.

(1) **DESIGN** - Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?
(2) **INSPECTION/MAINTENANCE** - Did inadequately or improperly maintained equipment, tools, workplace, etc., create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?
(3) **PERSONS PHYSICAL CONDITION** - Do you feel that the accident would probably not have occurred if the employee was in “good” physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was overexertion a factor?
(4) **OPERATION PROCEDURES** - Did lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?
(5) **JOB PRACTICES** - Were any of the provision of the Safety and Health Requirements Manual (EM 385-1-1) violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice (including EM 385-1-1) fail to adequately address the task or work process? Would better job practices improve the safety of the task?
(6) **HUMAN FACTORS** - Was the person under undue stress (either internal or external to the job)? Did the task tend toward overloading the capabilities of the person: i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach strengths, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?
(7) **ENVIRONMENTAL FACTORS** - Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun temperature changes, wind, tides, floods, currents, terrain; dust, mud, glare, pressure changes, lighting, etc., play a part in the accident?

(8) **CHEMICAL AND PHYSICAL AGENT FACTORS** - Did exposure to chemical agents (either single shift exposure or long-term exposure such as dusts, fibers, (asbestos, etc.), silica, gases (carbon, monoxide, chlorine, etc.), mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, by-products of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation (UV radiation created during welding, etc.) contribute to the accident/incident?
(9) **OFFICE FACTORS** - Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?
(10) **SUPPORT FACTORS** - Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources (in terms of employee skills, number of workers, and adequate supervision) available to get the job done properly? Was funding available, utilized and adequate to provide proper tools, equipment, personnel, site preparation, etc.
(11) **PERSONAL PROTECTIVE EQUIPMENT** - Did the person fail to use appropriate personal protective equipment (gloves, eye protection, hard-toed shoes, respirator, etc) for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard(s)? Did lack of or inadequate maintenance of protective gear contribute to the accident?
(12) **DRUGS/ALCOHOL** - Is there any reason to believe the person's mental or physical capabilities, judgment, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".
(13) **JOB/ACTIVITY HAZARD ANALYSIS** - Was a written Job/Activity Analysis completed for the task being performed at the time of the accident? If one was made, did it address the hazard adequately or does it need to be updated? If none made, will one be made? These may also need to be addressed in the Corrective Actions Taken section. Mark the appropriate box. If one was made, attach a copy of the analysis to the report.
(14) **MANAGEMENT** - Did the lack of supervisor or management support play a part in the mishap? Mark the appropriate box.

SECTION - 8 OSHA INFORMATION - Complete this section if applicable

SECTION 9 - REPORT PREPARER

Providing a completed CSIR to the Contracting Officer is the PRIME CONTRACTOR'S RESPONSIBILITY. Enter the name, date of report, title, employer, phone number and signature of person completing the accident report and provide it to the Contracting Officer, or his representative, responsible for oversight of that contractor activity. **NOTE!** If prepared by other than the Prime Contractor, a person employed by the Prime Contractor must sign that they have reviewed and concur with the report and it's findings (e.g. company owner, project supervisor/foreman, Safety Officer, etc.).

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

Todays 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 ___ 1st 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.

WITNESS DATA

Witness Name: Last ____________________________ First _____________________ MI _______

Address: ________________________________ City: ___________________ State: ____ Zip: ______

Telephone Number: (____) _____-______ Employed By: _________________________________

Statement Attached: Yes ___ No ___ Telephone Number: (____) _____-______

ACCIDENT ACTIONS/ANALYSIS

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: _____________________________

SUXO/PROJECT MANAGER

Corrective Actions/Recommendations: ____

SUXO Signature: _____________________________________ Date: ____/____/____

Concur With Actions Taken: Yes ___ No ___ Remarks: ____________________________________

Project Manager Signature: _____________________________ Date: ____/____/____

Is ENG Form 3394 to be submitted? Yes______ No____ If Yes, Dated: ___/___/_______

USA Environmental, Inc.

HEAT STRESS ALERT Field Monitoring and Alert Checklist		
DATE:	SURVEYOR(S):	
I. AREA INFORMATION		
LOCATION:		
SOURCE:		
ENGINEERING CONTROLS:		
II. SURVEY INSTRUMENT INFORMATION		
INSTRUMENT:	MODEL:	SERIAL #:
FACTORY CALIBRATION DATE:	PRE-CAL: BY:	POST-CAL: BY:
III. SAMPLING INFORMATION AND RESULTS		
HAZARD: Heat Stress	UNITS: °F (°C) WBGT	CORRECTIONAL FACTOR:
See attached printout or record below.		

TIME	WBGT-OUT (°F)	WB	DB	GL	COMMENTS

USA Environmental, Inc.

HEAT STRESS MONITORING LOG

Date:____________________ Site Name:__________________________ Conditions: __________________________

UXOSO:______________________________Location:____

Name	Organization	Start Time	Pulse Rate	Time	Pulse Rate	Time	Pulse Rate	Time	Pulse Rate

Remarks:

RECORD
OF
SAFETY VIOLATION OR NON-COMPLIANCE

Employee Name: ____________________________ Position: _____________________

Site / Location: ___________________________ Date: ____/____/____

Type of Violation: ____ PPE ____ Procedural ____ Explosive _____ Equipment ____ Other

Type of Non-Compliance: ____ Policy ____ Procedural ____ Directive _____ Contract
____ Other

Description of Violation or Non-Compliance:

____

____

Document Reference (Specify document, page, paragraph, etc. as applicable):

____

____

____

Corrective Action(s) to be taken:

____

____

____

____

Employee or Company Response and Comments:

____

____

____

Notification made to:

Manager: ____ Yes ____ No Date:

SUXOS: ____ Yes ____ No Date:

Supervisor: ____ Yes ____ No Date:

Corrective Actions Inspection Required: ____ Yes ____ No

If Yes, Date of Inspection: ____/____/___

Signature: _______________________________ Signature: __________________________________
Safety Officer Employee/Company Representative

SAFETY INSPECTION REPORT

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.

SAFETY MEETING/TRAINING RECORD

DATE: _____/_____/_____ **TIME: _________ AM PM**

LOCATION/SITE: ____________________________________

1. Reason for Meeting/Training: (Check all that apply)	
	Daily Safety Meeting/Training
	Initial Site Safety Meeting/Training
	New Task Briefing
	Periodic Safety Meeting/Training
	New Site Procedures
	New Site Information
	Periodic Review of Site Information
	Other (Explain):

2. Personnel Attending Meeting/Training:

Name	Signature	Company

USA Environmental Inc.

Safety Meeting/Training Record Cont.:

3. Topics Covered (Check all that apply)			
	Site Safety Personnel		**Decontamination Procedures**
	Site/Work Area Description		**Emergency Response Plan**
	Site Characterization		**Hazard Communication**
	Biological Hazard(s)		**On-Site Emergency**
	Chemical Hazard(s)		**On-Site Injuries/Illnesses**
	Physical Hazard(s)		**Evacuation Procedures**
	Heat Stress		**Rally Point(s)**
	Cold Stress		**Emergency Communication**
	Site Control		**Directions to Medical Facility**
	Work and Support Zones		**Drug and Alcohol Policies**
	PPE		**Medical Monitoring Program**
	Air monitoring		**Specific Task Training**
	Safe Work Practices		**Confined Spaces**
	Engineering Controls and Equipment		**Heavy Equipment**
	Spill Containment Procedures		**Other: (Specify)**
	MEC Hazard(s)		

4. Remarks:

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.

____

Site Safety Officer **Date: ____/____/____**

SITE VISITOR LOG

DATE:	NAME:	TITLE:	COMPANY:	SAFETY BRIEF:	TIME: IN	OUT	ESCORTED BY:	SITE:	REMARKS:

USA Environmental, Inc.

Tailgate Safety Briefing

Date: _____/_____/_____ **Location:**_______________________

Time: ______________ **AM PM** **Team #:** ________________________

1. Reason for Briefing:

	Daily Safety Briefing		New Site Procedure
	Initial Safety Briefing		New Site Information
	New Task Briefing		Review of Site Information
	Periodic Safety Meeting		Other: (Specify)

2. Personnel Attending:

Name	Signature	Position

Briefing Given By:

Name	Signature	Position

3. Topics: (Check All That Apply)

	Site Safety Personnel		Decontamination Procedures
	Site/Work Area Description		Emergency Response/Equipment
	Physical Hazards		On-Site Injuries/Illnesses
	Chemical/Biological Hazards		Reporting Procedures
	Heat/Cold Stress		Directions to Medical Facility
	Work/Support Zones		Drug and Alcohol Policies
	PPE		Medical Monitoring
	Safe Work Practices		Evacuation/Egress Procedures
	Air Monitoring		Communications
	Task Training		Confined Spaces
	MEC Precautions		Other:

4. Remarks:

APPENDIX F. USAE PROJECT FORMS

This appendix contains the following project forms for the Munitions Response Site at the Waikane Valley Impact Area:

- Corrective Action Request
- Corrective Action Request Log
- Daily Operations Summary
- Deficiency Notice
- Deficiency Notice Log
- Explosives Usage Form
- Explosive Vehicle Inspection Form
- Field Change Request
- Field Change Request Log
- Nonconformance Report
- Nonconformance Report Log
- Operator Instrument Test Form
- Personnel Qualification Verification Form
- QC Surveillance Tracking Form

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CORRECTIVE ACTION REQUEST

MEC Response at **(Project / Task Order Number)**

Adverse Trend: Yes No	CAR Number:	Date:

Organization/Project/Department:	Person Contacted:
Discrepancy (include specific requirements violated):	
Originator:	Response Due Date:
Corrective Action Taken/Proposed to Correct Discrepancy:	
Corrective Action Taken to Prevent Recurrence (the cause of the discrepancy must also be included here):	
Corrective Action Taken by (signature and date):	Date When Corrective Action Completed:
Corrective Action Evaluated:	Verification of Implementation:

Evaluated by:	Date:	Verified by:	Date:

CORRECTIVE ACTION REQUEST LOG

MEC Response at **(Project / Task Order Number)**

Contract No. N62742-05-D-1868

CAR No.	Orig. Date	Initiated By	Description	Responsible Party	C/A Due	Status	
Project No.	Close Date	Closed By				C/A Recommended & Approved	Re-inspection Results

DAILY OPERATIONS SUMMARY

DATE: ____/____/____

SITE / LOCATION: ____

1. WORK SUMMARY

a. Work Accomplished:	**Number Completed**	**Total Remaining**
(1) Survey	_______	_______
(2) Preparation	_______	_______
(3) Mag & Flag	_______	_______
(4) Geophysical	_______	_______
(5) Intrusive	_______	_______
(6) Quality Control	_______	_______
(7) Quality Assurance	_______	_______

b. Discrepancies: ____
____
____
____

c. Inspection Results:	**Pass**	**Fail**
(1) Quality Control	_______	_______
(2) Quality Assurance	_______	_______
(3) Safety	_______	_______

2. INSTRUCTIONS RECEIVED FROM CUSTOMER REPRESENTATIVE: __________
____
____
____
____

3. UXO SUMMARY

a. UXO Located:

Type:	Quantity:	Live/Prac.:	Remarks:

b. Demolition Supplies Expended:

Type:	Quantity:	Remarks:

c. Scrap Generation / Deposition:

Type:	Quantity:	Weight:	Remarks:

4. **Utilization**

a. **Daily Man-hours:**

Labor Category:	Task #	M/H Today:	M/H 0% :	M/H 4%	M/H 8%
Site Manager					
SUXOS					
UXO Technician III					
UXO Technician II					
UXO Technician I					
Laborer					
UXOSO					
UXOQCS					
Admin Personnel					
Visitor					
DGM					
GIS					
Sub-Contractor Personnel (List by Category)					

b. Daily Equipment:

Description:	Task:	Hours Used:	Hours Remaining:	% Hours Remaining:	Remarks:

5. Operational Remarks:

____

____

____

____

____

____

6. Signature / Date:

____________________________________ **Date: ____/____/____**

SM/SUXOS

____
PROJECT

DEFICIENCY NOTICE

RESPONSIBLE ORGANIZATION ______________________________ D.N. No. ______________________________
DEFICIENT CONDITION ______________________________ DATE ______________________________
LOCATION ______________________________

I. DESCRIBE DEFICIENCY:______________________________

QC Notification Required Prior to Initiating Corrective Action: Yes_____No_____ Hold Tag No.______________________________
D.N. Prepared by: ______________________________ Approved by: ______________________________
SITE CQC REPRESENTATIVE

II. CORRECTIVE ACTION:______________________________

ORGANIZATION	SIGNATURE	DATE

III. REINSPECTION
Results:
_____ Accept
_____ Reject - Reissue Under: D.N. No. ______________________________ NCR No. ______________________________

INSPECTOR	DATE
SITE CQC REPRESENTATIVE	DATE

IV. DISTRIBUTION

Responsible Organization: ______________________________ Program QC Manager: ______________________________
Site Superintendent: ______________________________ Task Order Manager: ______________________________
Program Manager: ______________________________

____
Project

DEFICIENCY NOTICE LOG

D.N. NO.	DESCRIPTION OF DISCREPANCY	TAG NO.	ISSUE DATE	DATE CLOSED	REMARKS

EXPLOSIVE USAGE RECORD

Contract Number: ____________

Team Number: ________ *Date:* ________ *Project Name:* ____________

Team Leader: ____________ *Work area/Grid Number:* ____________

EXPLOSIVES	LOT NUMBER	QUANTITIES						Signatures	
		Issued	*Initials*	*Used*	*Initials*	*Returned*	*Initials*	*Team Leader*	*Checker*

Reviewed and Accepted: ______________________ **Date:** ____________

Senior UXO Supervisor

USA Environmental, Inc.

Explosive Vehicle Inspection, ON-SITE

This form must be filled out for any vehicle carrying explosives, prior to loading.
This form is for use on site only, if traveling on public highways use DD Form 626

DRIVERS NAME ______________________ LICENSE NUMBER ______________________
COMPANY ______________________
TYPE OF VEHICLE ______________________ VEHICLE NUMBER ______________________
INSPECTION DATE/TIME ______________ INSPECTOR ______________________

PART INSPECTED	**SAT.**	**UNSAT.**	COMMENT
HORN			
STEERING SYSTEM			
WIPERS			
MIRRORS			
FIRE EXTINGUISHERS (10 ABC, 2 EACH)			
REFLECTORS			
EMERGENCY FLASHERS			
LIGHTS			
ELECTRIC WIRING			
FUEL SYSTEM			
EXHAUST SYSTEM			
BRAKE SYSTEM			
SUSPENSION			
CARGO SPACE			
TIRES, WHEELS, RIMS			
TAILGATE			
TARPAULIN			

INSPECTION RESULTS (INSPECTOR INITIAL) ACCEPTED ______________

REJECTED ______________

REMARKS ____

DRIVERS SIGNATURE/DATE INSPECTORS SIGNATURE/DATE

______________________ ______________________

FIELD CHANGE/REVISION REQUEST FORM

Date:	**Department:**	**Name:**
Change or Revision:	**Plan/Procedure/SOP Name or #:**	
Site Location:		

Preliminary Information

Current Document	Check All That Apply	Supporting Documentation (List document, page, para., etc.)	Submitted By (Initials)	Reviewed By (Initials)
Change or Revision Due To:				
1. Regulatory Update				
2. Contract Requirement				
3. Equipment Change				
4. Newly Identified				
a) Safety Hazard				
b) QC Measure				
c) Operational Issue				
5. Other:				

Summary of Change or Revision: (Identify procedural, contractual, equipment, or operator and how this affects the current SOP)**:**

Change or Revision Requested: (Identify page, para, figure, table, etc. that is changed or revised)

Requestor's Signature:	
Change or Revision: Accepted Rejected **Reason for Rejection** –	**Reviewers Signature:** **Safety/QC Signature:**
Corporate: Concurrence Non-Concurrence	**Corporate Approval Signature:**
Navy: Concurrence Non-Concurrence	**Navy Approval Signature**

FIELD CHANGE REQUEST LOG

FCR No.	DESCRIPTION OF CHANGE	DATE INITIATED	STATUS
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			

USA ENVIRONMENTAL, INC.	REPORT NO:	
CLIENT:	PROJECT NO:	
PROJECT:	TASK ORDER NO.	
	DATE:	
NONCONFORMANCE REPORT	LOCATION:	

DESCRIPTION OF ITEM OR PROCESS:				
SPEC/DRAWING/PLAN OR PROCEDURE NO.:				
SECTION 1 - DESCRIPTION OF NONCONFORMANCE				COMPLETED BY INITIATOR
ORIGINATOR:		TITLE/COMPANY:		
SIGNATURE:		DATE:	01/00/00	
SECTION 2 - RESPONSE/PLANNED CORRECTIVE ACTION				COMPLETED BY RESPONSIBLE PARTY
NAME:		TITLE/COMPANY:		
SIGNATURE:		DATE:		
SECTION 3 - RECOMMENDED DISPOSITION				COMPLETED BY T.O.M. OR PROJECT MANAGER
☐ USE-AS-IS		☐ OTHER: Specify Below		
☐ REPAIR		☐ DCN / FCR Required		
☐ REWORK TO SPECIFICATIONS		☐ DCN / FCR Not Required		
COMMENTS:				
NAME:		TITLE/COMPANY:		
SIGNATURE:		DATE:		

NONCONFORMANCE REPORT				
REPORT NUMBER:	0		**DATE:**	01/00/00

SECTION 4 - EVALUATION				PROJECT MANAGER TO DETERMINE NECESSARY EVALUATIONS
NAME:		**TITLE/COMPANY:**		
SIGNATURE:		**DATE:**		
DISPOSITION / CORRECTIVE ACTION IS:		☐ ACCEPTED	☐ REJECTED WITH COMMENTS	
FCR / DCN GENERATED:	☐ YES (ATTACH COPY) ☐ NO	**FCR / DCN NO.:**		
COMMENTS:				
NAME:		**TITLE/COMPANY:**		
SIGNATURE:		**DATE:**		
DISPOSITION / CORRECTIVE ACTION IS:		☐ ACCEPTED	☐ REJECTED WITH COMMENTS	
COMMENTS:				

NONCONFORMANCE REPORT				
REPORT NUMBER:	0		**DATE:**	01/00/00

SECTION 5 - VERIFYING CORRECTIVE ACTION				PQM TO DETERMINE VERIFICATION
VERIFICATION NEEDED?	☐ YES ☐ NO	**PERSON RESPONSIBLE:**		
DESCRIPTION OF VERIFICATION TO BE PERFORMED:				
COMMENTS FROM VERIFYING PARTY				
SIGNATURE OF VERIFYING PARTY:		**DATE:**		

SECTION 6 - CLOSING THE NONCONFORMANCE				PQCM OR DESIGNEE
The information contained on this Nonconformance Report had been reviewed and has been found sufficient to satisfactorily close this issue.				
NAME:		**TITLE/COMPANY:**		
SIGNATURE:		**DATE:**		
ATTACHMENTS:	☐ YES ☐ NO	**DESCRIBE:**		

INSTRUCTIONS (CONSULT PROCEDURE QC-3, OR CONTACT QA/QC DEPARTMENT FOR MORE INFORMATION):	
INITIATOR: **Section 1**	1. Consult NCR Log for appropriate NCR number 2. Complete header and Section 1 of form. 3. After Section 1 is complete, forward a copy of the NCR to the DOM, QC Manager, and Program Manager. 4. Route NCR to responsible Site Superintendent or Department Head.
RESPONSIBLE PARTY: **Section 2**	1. Complete Section 2 of NCR. 2. Corrective Action should be appropriate to the magnitude of the nonconformance and commensurate with the project and/or programmatic impact. 3. Forward NCR to appropriate Project Manager or Department Head.
PROJECT MANAGER: **Section 3**	1. Recommend disposition or route to Program Quality Manager for disposition. **USE-AS-IS, CHANGE REQUIREMENTS BY DCN / FCR :** The work will be accepted "as is". A DCN / FCR will be written to change the specification to reflect the condition. **REWORK TO SPECIFICATIONS:** The item will be reworked or replaced to meet the specifications. **REPAIR, VARIANCE BY DCN / FCR:** The item will be repaired as required to meet design intent, however, a variance to the specification is needed. Requires technical justification and documentation, in the form of a DCN / FCR.
PROJECT MANAGER: **Section 3**	1. Indicate reviewers as needed from affected disciplines and organizations who shall review NCR disposition and corrective 2. N/A all sections not used 3. Begin routing process.
EVALUATORS: **Section 4**	1. Indicate acceptance or rejection of the corrective action and disposition. **ACCEPTED:** The information presented provides sufficient justification that the corrective action will remedy the nonconforming condition. Proceed with work. **ACCEPTED WITH COMMENTS:** The information presented provides sufficient justification that the corrective action will remedy the nonconforming condition, after changes in recognition of the reviewer's comments. Proceed with work provided the work addresses comments noted. **REJECTED:** The corrective action is unacceptable and shall be revised and resubmitted. Work associated with the corrective action shall not proceed. 2. Route to PQCM (or designee).
VERIFYING PARTY: **Section 5**	1. Perform and document verification as described. 2. Complete Section 5. 3. Return NCR to PQCM (or designee).

NONCONFORMANCE REPORT LOG

CONTRACT: **CTO:**

NCR NO.	HOLD TAG NO.	DESCRIPTION OF CONDITIONS/ ITEM AFFECTED	LOCATION	DATE					REMARKS
				VALIDATION	DISPOSITION/ APPROVAL	RE-INSPECTION	CLOSURE	HOLD TAG REMOVAL	

USAE
Operator/Instrument Test Form
FOR MEC OPERATIONS

DATE:	**TIME:**	**NAME:**
TEAM #:	**INSTRUMENT/SERIAL #:**	
SITE NAME AND LOCATION:		
WEATHER CONDITIONS:		

TEST AREA (List by grid number, lane, marker number, or other identifier)**:**

TEST ITEM(S) (List test item by type, depth, and quantity)**:**

BLIND SEED ITEM(S) (List type, depth, and quantity)**:**

II. TEST RESULTS

Item Description	Pass	Item Description	Pass
1. Instrument Checked for Broken/Missing Components	Y / N	9. Operator Familiar with W.P. Procedures	Y / N
2. Instrument Serviceability Check Performed	Y / N	10. Instrument Trained Operator	Y / N
3. Correct Settings Selected for the Instrument	Y / N	11. Instrument Passed Test Area	Y / N
4. Correct Survey/Sweep Techniques Employed	Y / N	12. Operator Passed Test Area	Y / N
5. Instrument Responsive to Test Item(s)	Y / N		
6. Operator Responsive to Instrument Signal/Sound	Y / N	Was a Blind Seed Item (BSI) Employed	Y / N
7. Operator Locates Point of Origin for Test Item(s)	Y / N	Did the Instrument Locate the BSI	Y / N
8 Operator Familiar with Pass/Fail Criteria	Y / N	Did the Operator Locate the BSI Origin	Y / N

SUMMARY OF DEFICIENCIES NOTED (Identify if procedural, process, instrument, or operator)**:**

CORRECTIVE ACTIONS RECOMMENDED (As required)**:**

Instruments failing the test will tagged and removed from service until repaired or replaced.

Individuals will be corrected on deficient procedures, processes, techniques, and/or re-trained to acceptable standards.

VI. SIGNATURES:

I acknowledge that I have been briefed on the results of this test and will take corrective actions as identified by the QC Section.

UXOQCS/UXOT III

INSTRUMENT OPERATOR

Note: QC test are to be conducted for the instrument and operator each day and documented on this form. This form will also be used to document the current status of deficiencies noted during daily tests. Any daily test forms where deficiencies have been noted will be forwarded to the Project Manager and to the USAE QC Manager.

PERSONNEL QUALIFICATION VERIFICATION FORM

NAME: ______________________________ **POSITION** ______________________

CONTRACT:

REVIEW ITEMS		QUALIFICATIONS	VERIFIED BY/DATE
EXPERIENCE	REQUIRED:		
	ACTUAL:		
EDUCATION	REQUIRED:		
	ACTUAL:		
CERTIFICATIONS & QUALIFICATIONS	REQUIRED:		
	ACTUAL:		
TRAINING	REQUIRED:		
	ACTUAL:		
OTHER	REQUIRED:		
	ACTUAL:		

MEC RESPONSE

N62742-05-D-1868 CTO 0010

QC SURVEILLANCE TRACKING FORM

Item No.	Definable Feature of Work	Prep		Initial		Follow up		Remarks
		Sched. Date	Actual Date	Sched. Date	Actual Date	Sched. Date	Actual Date	

APPENDIX G

H. ENVIRONMENTAL PROTECTION PLAN

This appendix contains the environmental protection plan for the Munitions Response Site at the Waikane Valley Impact Area.

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ACRONYMS AND ABBREVIATIONS

ARARs	Applicable, Relevant, and Appropriate Requirements
BMP	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CWA	Clean Water Act
DOD	Department of Defense
DOT	Department of Transportation
EPP	Environmental Protection Plan
Gal	gallons
HDOH	Hawaii Department of Health
Lbs	Pounds
MC	Munitions Constituents
MD	Munitions Debris
MEC	Munitions and Explosives of Concern
MMR	Military Munitions Rule
MPPEH	Munitions Potentially Presenting an Explosive Hazard
MSDS	Material Safety Data Sheet
OD	Open Detonation
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TBC	To Be Considered
TBD	To Be Determined
USAE	USA Environmental, Inc.
USEPA	United States Environmental Protection Agency
WVIA	Waikane Valley Impact Area

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1.0 ENVIRONMENTAL PROTECTION PLAN

This Environmental Protection Plan (EPP) describes the approach, methods, and operational procedures to minimize pollution, protect and conserve natural resources, or restore damage during this Remedial Investigation (RI). Surface activities will include collection of surface soil samples; vegetation clearance to gain access to target areas; and a clearance of munitions and explosives of concern (MEC) from the ground surface over the entire target areas. Intrusive activities at Waikane Valley Impact Area (WVIA) will include collection of subsurface soil samples (0-36 inches depth) and investigation of subsurface metallic anomalies to a maximum depth of 4 feet within 32 grids totaling 2 acres.

Results of site inspections will be recorded in field notebooks, and photographs will be taken as necessary to document observations of species or suitable habitats. If protected species are identified, USAE will evaluate the surrounding area to recommend relocation of inspection activities, if possible. Proposed mitigation strategies would be coordinated with appropriate state or Federal agencies.

1.1 PRELIMINARY IDENTIFICATION OF ARARS AND TO BE CONSIDERED DOCUMENTS

1.1.1 ARARS DEFINITION

Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requires that site cleanups comply with Federal Applicable, Relevant and Appropriate Requirements (ARARs), or with state ARARs in cases where these requirements are more stringent than Federal requirements. ARARs are derived from both Federal and state laws. Under CERCLA Section 121(d)(2), the Federal ARARs for remedial action could include requirements under any of the federal environmental laws. Federal and state regulators are provided the opportunity to review this document and comment on the applicability, relevance or appropriateness of the potential ARARs.

A requirement may be either “applicable” or “relevant and appropriate.” Applicable requirements are defined in the 40 CFR 300.5 as “those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be applicable.”

A requirement is applicable if the specific terms of the statute or regulation directly address the circumstances at the site. If not applicable, a requirement may be relevant and appropriate if circumstances at the site are sufficiently similar to the problems or situations regulated by the requirement. “Relevant and appropriate” is defined in 40 CFR 300.5 as “those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than Federal requirements may be relevant and appropriate.”

The relevance and appropriateness of a requirement can be judged by comparing a number of factors including the characteristics of the remedial action, the items in question, or the physical circumstances of the site, with those addressed in the requirement. If there is sufficient similarity between the requirements and circumstances at the site, determination of the requirement as relevant and appropriate may be made. Determining whether a requirement is both relevant and appropriate is a two-step process. First, to determine relevance, a comparison is made between the response action, location, or chemicals covered by the requirement and related conditions at the site, release, or potential remedy. A requirement is relevant if it generally pertains to these conditions. Second, to determine whether the requirement is appropriate, the comparison is further refined by focusing on the nature of the items, the characteristics of the site, the circumstances of the release, and the proposed response action. The requirement is appropriate if, based on such comparison, its use is well suited to the particular site. The facility must comply with requirements that are determined to be both relevant and appropriate.

ARARs that govern actions at CERCLA sites fall into three broad categories based upon the chemical contaminants present, site characteristics, and alternatives proposed for cleanup. These three categories (chemical specific, location specific, and action specific) are described in the following subsections.

1.1.1.1 Chemical-Specific ARARs

Chemical-specific ARARs include those environmental laws and regulations that regulate the release to the environment of materials with certain chemical or physical characteristics or that contain specified chemical compounds. These requirements generally set health- or risk-based concentration limits or discharge limits for specific hazardous substances by media. Chemical-specific ARARs are triggered by the specific chemical contaminants found at a particular site. The SI sampling results indicate that copper and lead are present above action levels.

1.1.1.2 Location-Specific ARARs

Location-specific ARARs govern activities in certain environmentally sensitive areas. These requirements are triggered by the particular location and the proposed activity at the site. Location-specific ARARs, for example, focus on wetland or floodplain protection areas, or on archaeologically significant areas.

1.1.1.3 Action-Specific ARARs

Action-specific ARARs are restrictions that define acceptable treatment and disposal procedures for hazardous substances. These ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities. An example might be a state Air Quality Management Authority that sets limitations on fugitive dust generated during grading and excavation activities during a removal action.

1.1.2 TO BE CONSIDERED

In addition to ARARs, non-promulgated criteria, advisories, guidance or policies referred to as “to be considered” (TBC) materials may also apply to the conditions found at a site. Unlike ARARs, identification of and compliance with TBCs are not mandatory or legally binding. However, where a TBC is used as a cleanup level, its use for this purpose should be explained and justified.

1.1.3 IDENTIFICATION OF SITE-SPECIFIC ARARS

In determining whether a requirement was pertinent to future munitions response actions, potential ARARs were initially screened for applicability. If determined not to be applicable, the requirement was then reviewed for both relevance and appropriateness. Requirements that are considered relevant and appropriate command the same importance as applicable requirements. Potential Federal and state ARARs and TBCs determined to be specific to the Waikane Valley Impact Area are identified in Table 1-1, along with common standards that have been screened out as not applicable, relevant or appropriate.

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Table 1-1: Potential ARARs and TBCs, Waikane Valley Impact Area

Requirement	Citation	Description	Type	ARAR	Comments
Federal					
Endangered Species Act	16 U.S.C. 1531-1543	Prohibits the taking of listed species, except as allowed by regulations.	Location-specific	Yes, Applicable	No endangered plant or animal species or their habitats are known to exist on site.
Migratory Bird Treaty Act	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	Yes, relevant and appropriate	Migratory birds are known to pass over the area, although no nesting habitats are believed to exist on site.
National Historic Preservation Act	16 U.S.C. 470	Requires action to be taken to locate, identify, evaluate, and protect cultural resources.	Location-specific	Yes, Applicable	If properties are uncovered or existing sites affected by response actions, conditions of the NHPA must be followed.
RCRA Subpart M (Military Munitions Rule)	62 Federal Register 662	Identifies when military munitions become a solid waste, and, if these wastes are hazardous, the management standards that apply.	Chemical-specific	Yes, Applicable	Recovery, collection, and on-range destruction of UXO and munitions fragments are not subject to hazardous waste regulations or permits.
Regional Screening Levels	USEPA User's Guide and Background Technical Document for USEPA Region 9 Preliminary Remediation Goals Table	Provides chemical-specific screening action levels designed to protect human and ecological receptors	Chemical-specific	No, TBC	Document not promulgated, but is a user’s guide and technical reference which can be considered a TBC.

Requirement	Citation	Description	Type	ARAR	Comments
Protection of Wetlands	Executive Order 11990	Restricts federal activities when alterations of wetlands may occur.	Location-specific	Yes, if wetlands are present	MEC response does not involve wetlands alterations.
Floodplain Management	Executive Order 11988	Restricts activities within the 100-year floodplain	Location-specific	Yes, if construction proposed along Waikane Stream	MEC response does not involve alteration of Waikane Stream
Clean Water Act (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.	Location-specific	Yes	A MEC response action at this site will minimize impacts on surface water or groundwater.
CWA (Section 404)	33 CFR Part 320 et seq.	Requires action to minimize loss or degradation of wetlands. Responsible agencies include the USACE, USFWS, and USEPA.	Location-specific	Yes, if wetlands are present	A MEC response action at this site will have no impacts on wetlands.
Resource Conservation and Recovery Act (RCRA)	40 CFR Part 261.23	Identifies solid waste subject to regulation as hazardous; waste considered hazardous versus explosive would be handled as such.	Chemical-specific	No	Procedural requirement, no site-specific criteria.
Transportation	49 CFR Parts 100-199	Regulates transport of hazardous substances, including explosives and other MEC.	Action-specific	No	Procedural requirement.

Requirement	Citation	Description	Type	ARAR	Comments
Fish & Wildlife Coordination Act	16 U.S.C. 661 et seq.	Prohibits actions from harming local fish and wildlife	Location-specific	No	Procedural requirement. No body of water is affected. However, activities will occur in areas populated with wildlife. Coordination with Fish and Wildlife Service is recommended.
State					
Conservation of Aquatic Life, Wildlife, and Land Plants	HRS (Title 13) Chapter 195D	Provides for the protection of indigenous aquatic life, wildlife, and land plants and their habitats.	Action-specific	No, TBC	Procedural requirement. However, activities will occur in areas populated with wildlife. Coordination with Hawaii Department of Land and Natural Resources is recommended.
Historic Preservation	HRS (Title 13) Chapter 6E	Requires action to be taken to locate, identify, evaluate, and protect cultural resources.	Location-specific	No, TBC	Procedural requirement, no site-specific criteria. Coordination with Hawaii Department of Land and Natural Resources is recommended.
Environmental Action Levels	HDOH Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Volume 1, and Volume 2: Background Documentation for the Development of Tier 1 Environmental Screening Levels, Appendix 1	Provides chemical-specific environmental screening criteria and action levels designed to protect human and ecological receptors.	Chemical-specific	No, TBC	Document is not promulgated, but is a user's guide and technical reference which can be considered a TBC.

Requirement	Citation	Description	Type	ARAR	Comments
Hazardous Waste Management	HAR (Title 11) Chapters 260-266, 268, 270, 271, 280	Regulates waste management in Hawai'i.	Action-specific	No	Administrative requirements.
Transportation of Hazardous Materials	HRS (Title 17) Chapter 286	Regulates transport of hazardous substances in Hawai'i.	Action-specific	No	Procedural requirement, no site-specific criteria.
Hazardous Waste	Hazardous Waste JRS [Title 19] 342J	Provides classification of hazardous waste. Regulates generators, transporters, and treatment, storage, or disposal facilities.	Chemical-specific	No	Procedural requirement, no site-specific criteria.
Forest Reservations, Water Development, Zoning	HRS (Title 13) Chapter 183	Regulates activities in forested land and watersheds.	Location-specific	No	Procedural requirement, no site-specific criteria.
Protection of Archaeological Resources	43 CFR 7.4 (a), 7.5 (b)(1)	Requires protection of archaeological resources if discovered	Location-specific	Yes	See Appendix H Archaeological Monitoring Plan
Native American Graves Protection and Repatriation Regulations	43 CFR 10.4 (c) and (d)	Requires consultation with Native Hawaiian organization to determine disposition of objects discovered	Location-specific	Yes, if grave discovered	If grave discovered will stop activities in area of discovery, and secure and protect the objects
Protection of Caves	HRS 0006D	Protects caves and contents	Location-specific	Yes, if cave discovered	If cave discovered

1.2 ENDANGERED/THREATENED SPECIES PROTECTION

The Endangered Species Act requires that this action not jeopardize the continued existence of endangered or threatened species, or their habitats. Surveys of the site conducted by Char and Associates (1989) and AECOS Consultants (2003) found no federally listed threatened or endangered plant species and no plants proposed for listing. The Migratory Bird Treaty Act prohibits the taking, possessing, buying, selling, or bartering of any migratory bird, including feathers or other parts, nest eggs, or products.

The endemic Hawaiian sub-species of the Short-eared Owl was not detected during surveys but may use resources present within the site, especially in the higher elevations of the valley wall. Typical nesting habitat for the threatened Newell's Shearwater is also found on the upper slopes, but there are no known colonies of this species on Oahu. The RI fieldwork is scheduled to avoid the higher, steeper slopes and will not intrude on these areas.

1.3 WETLANDS PROTECTION

The Wetlands Protection Act requires that this action be taken in such a manner as to minimize loss or degradation of wetlands. A field survey conducted at the project site (AECOS Consultants 2003) revealed no distinct wetlands.

1.4 MITIGATION PROCEDURES FOR MEC

USEPA's Military Munitions Rule (MMR) amended RCRA to regulate the disposal of all types of conventional and chemical ammunition products and their components. Under the MMR, used or fired military munitions are solid wastes when they are removed from their landing spot and then either:

- Managed off range (i.e., when transported off range and stored, reclaimed, treated, or disposed of)
- Disposed of (i.e., buried or landfilled) on range
- Located off range due to off-range landing and not promptly rendered safe and/or retrieved (statutory solid waste)

Under current RCRA and DoD regulations, MEC management procedures depend upon the location of the items. MEC which is located on range will not be considered solid waste, while MEC located or transported off range for disposal will be considered solid waste under RCRA.

A *military range* is defined under RCRA as "designated land and water areas set aside, managed, and used to conduct research on, develop, test, and evaluate military munitions and explosives, other ordnance, or weapon systems, or to train military personnel in their use and handling. Ranges include firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, and buffer zones with restricted access and exclusionary areas." WVIA is managed as an "other than operational range", with access controlled by Marine Corps Base Hawaii such that civilians may only enter the property when accompanied by Explosive Ordnance Disposal personnel.

During the RI work, all MEC found will be disposed of within the site boundaries using the open detonation (OD) treatment process in accordance with SOP 6, Explosive Demolition for Disposal of Munitions [(see Appendix B MEC Sampling and Analysis Plan (SAP)]. Donor explosives will be transported as necessary on public roads, by air, or by vessel in accordance with all Federal and state requirements.

Other project wastes may be generated during the RI activities and will require off-site disposal or treatment, including transportation of munitions debris (MD) to the mainland at the end of the field work. These project wastes will not be hazardous and the RCRA requirements and U.S. Department of Transportation (DOT) Hazardous Material Regulations will not apply. Media samples collected for munitions constituents (MC) analysis during the RI field activities, though not considered hazardous, may have specific packaging, labeling, and documentation requirements when shipped off island to the laboratory by air transport, which must be done by a DOT-trained individual.

MPPEH will be inspected, sealed in drums, and certified in accordance with SOP 7 MPPEH Management (see Appendix B MEC SAP). At the end of the fieldwork, the drums will be shipped to a recycler under chain of custody to undergo the demilitarization process.

Exclusion zones are established for protection of the public in accordance with Appendix B MEC SAP.

1.5 OTHER PROJECT WASTES

This section includes requirements for the proper characterization of all project wastes, and general waste transport and disposal requirements. Table 1-2 summarizes the anticipated waste streams and quantities. They are described in further detail in the sections immediately following; however, quantities and waste stream characteristics may vary. Waste streams will be further established on site through investigation and/or generator knowledge, or through sampling and analysis (the waste characterization process) to ensure project wastes are properly disposed of at the end of the project or field season (as required). It should be noted that it is not anticipated that hazardous waste will be generated during the RI; however, all project wastes must be characterized properly at the time of generation to determine what regulatory requirements apply. All project waste will be disposed of off-site with the exception of MEC and ordinary trash as outlined in the following sections.

Because this project is a CERCLA action, project wastes containing CERCLA hazardous substances, including hazardous wastes being disposed of off-site, must be disposed of at a facility approved under the CERCLA Off-site Rule requirements in Section 121(d)(3) of CERCLA. The purpose of the Off-site Rule is to avoid having CERCLA wastes or CERCLA hazardous substances from response actions contribute to present or future environmental problems by directing these wastes to management units determined to be environmentally sound.

Table 1-2: Summary of Anticipated Waste Streams and Quantities

Potential Waste Stream	Estimated Quantity
Munitions debris	8 drums
Non-munitions metal debris	200 lbs
Used personal protective equipment (PPE) and disposable sampling debris	2 gal
Ordinary trash[1/]	50 gal
Non-hazardous subtitle D debris (wood, plastic, etc.)[2/]	50 gal
Decontamination waters	5 gal
Donor explosives	None
Oily rags and sorbents	5 gal
Excess hazardous materials brought on site by contractor or subcontractor that are not consumed on project	TBD
Unanticipated or unknown wastes	TBD

[1/] RCRA subtitle D, non-hazardous solid waste and debris (no free liquids).
[2/] The composition of ordinary trash is further defined in Section 12.6.4 below.
cy – cubic yards
TBD – To be determined

The following sections are a general guideline for the management of the anticipated waste streams. The contractor will ensure the project is in compliance with applicable regulations throughout the duration of the project.

1.5.1 MUNITIONS DEBRIS

USAE will transport MD off site to a certified scrap metal recycler for demilitarization in accordance with SOP 7, MEC SAP.

1.5.2 NON-MUNITIONS METAL DEBRIS

Non-munitions metal debris discovered during the RI will be removed from the site and delivered to a scrap dealer off site.

1.5.3 CONTAMINATED PPE AND DISPOSABLE SPENT SAMPLING DEVICES (NON-LIQUID)

Used PPE and used disposable sample equipment from MC sampling operations may consist of used sampling scoops, bailers, used gloves, etc. The majority of used PPE and sample equipment will be considered contaminated with MC if they are used and have come into direct contact with potential MC-contaminated soil.

This debris will require proper waste characterization for disposal based on site conditions and levels of MC in the soil samples. However, it is anticipated that this waste stream will be characterized as non-hazardous waste, suitable for off-site disposal at a subtitle D landfill, or approved municipal solid waste landfill.

1.5.4 ORDINARY TRASH

Ordinary trash consists of paper materials, plastic cups and bags, trash bags, non-contaminated materials, and food waste. Ordinary trash generated by work crews will be removed from the site. Pre-existing ordinary trash will be left on-site. Waste from RI activities will not be mixed with ordinary trash.

1.5.5 SUBTITLE D DEBRIS

Subtitle D waste debris includes debris that is not characterized as a hazardous waste under RCRA. A subtitle D permitted landfill accepts non-hazardous solid wastes and debris and non-hazardous industrial wastes. The waste profile sheet must contain a list of all waste materials that comprise this waste stream to ensure that all of the items are acceptable at the intended facility. This category is anticipated to consist of empty containers (non-aerosol) and non-munitions-related debris.

In addition, if these materials are characterized at the point of generation as non-hazardous wastes, this waste stream may also contain other waste materials suitable for subtitle D landfill. These other wastes may include oily waste solids (liners, sorbent materials with no free liquids contaminated with diesel, motor oil, or hydraulic fluid from vehicle maintenance or spill cleanup [not gasoline]); non-hazardous PPE and used disposable sample equipment; or other non-hazardous debris that has been properly characterized by the contractor and is approved on the waste profile sheet for this waste stream.

Items that can be recycled will be to the extent practicable; however, it is anticipated that the amount of materials will not be substantial enough to warrant segregation for recycling, with the possible exception of non-munitions metal debris.

Open head drums or bulk containers may be used to accumulate this waste stream.

1.5.6 DECONTAMINATION WASTEWATERS

Decontamination water from personnel or equipment used during sampling will be kept to a minimum to the extent possible by use of disposable sampling equipment and PPE that will not require decontamination. This would also limit or eliminate having to collect source or rinsate blanks that require laboratory analysis. If generated, decontamination wastewaters will be sampled and analyzed for proper characterization and disposal based on the suspected or known contaminants (e.g., MC, lead, etc). The disposal facility may have additional sample requirements, so it will be important to verify what is required before sampling.

It is anticipated that decontamination waters, if generated, will all be non-hazardous waste; however, this determination will be made by USAE and the Navy based on actual generation. Decontamination wastewaters will be accumulated and stored in closed-head (bung top) drums and will be marked "decontamination water from *(source)*." Drums will be stored in an authorized off-site location pending disposal decision. Should sample results show the decontamination wastewater is not hazardous waste and the contaminant levels are at or below project screening criteria, the decontamination waters may be allowed to remain on site. This determination, and the location of onsite disposal, will be made with Navy and HDOH approval.

1.5.7 OILY RAGS AND SORBENT MATERIALS

Oily rags and sorbent materials (pads, rags, booms, or kitty litter) may be generated in the event of a spill or leak of fuel or oily water, or during routine vehicle maintenance.

Oily sorbent materials will be placed into open-top drums (or equivalent) for disposal off site or can be bagged (so they do not cause further contamination by leaching) and placed into the subtitle D waste stream if approved on the waste profile after proper waste characterization.

Free liquids may not be present in the sorbent materials that are sent to landfills. Also, free liquids must not be allowed to leach back out of the materials or out of containers in which they are stored. Free liquids will be allowed to drain out of the sorbent materials into a separate container, or additional sorbent materials, such as kitty litter, will be placed onto the materials so that free liquids are entrained within the sorbent materials and cannot drip. This will be performed in a manner that does not cause spillage into the environment. Because contact with rainwater can cause oil to leach out of oily waste, any containers of oily waste will be kept closed, secured, or otherwise have no holes (i.e., bags placed into subtitle D waste container) and the weight of the contents shall not cause the container to breach and leak.

If any gasoline rags and absorbents are generated (i.e., from a gasoline spill from a gas can or fuel tank), they will be segregated from the diesel- or oil-stained materials and sorbents. Gasoline contains benzene and these absorbents will be managed as hazardous waste or will be sampled to determine if they exhibit a characteristic for benzene or ignitability causing them to require management as hazardous waste. The Navy will be notified if gasoline-soaked sorbent materials are generated. These materials will be accumulated in an open-top (non-bung top) steel drum that is sufficiently sized for the waste so as to not have a high volume of head space in the container.

1.5.8 CONTRACTOR HAZARDOUS MATERIALS BROUGHT ON SITE

Hazardous materials brought on site or used on site to support project activities (i.e., spray paint, lubricants, grease, etc.) will be properly disposed of or reused at the end of the project.

The shipment of hazardous materials (even if not waste) off site must be done in accordance with applicable DOT hazardous material requirements of either air carrier or vessel shipment. To the extent possible, the materials will be shipped in their original containers with their original markings and labeling (and additional markings if required).

If the materials have no further use or become spent during the project, they will be characterized for proper disposal and shipped off site as a waste, whether hazardous or non-hazardous. Note: this is in part why it is critical to control the inventory of hazardous materials brought on site in the first place and especially what is imported by subcontractors. Inventory control and review of hazardous materials and Material Safety Data Sheets (MSDSs) will be performed for all products brought on site to support project activities.

Empty containers will be disposed of with the subtitle D waste materials. The containers will be deemed empty according to RCRA regulations. The container is considered to be empty if it has been emptied by normal means and contains less than 1 inch of material, or 3 percent of the capacity of the container (by weight).

1.5.9 DONOR EXPLOSIVES

The contractor will transport donor explosives and initiating materials to the project site for demolition operations. These items will be DoD Hazard Class/Division 1.1. Specific procedures for the purchase, receipt, transport, storage, and accountability for explosives are contained in SOPs 6 and 7 in the MEC SAP. The contractor is responsible for explosives receipt, transport, storage, and accountability, as well as planning, directing, and executing all explosive disposal operations and ensuring the safety of all personnel. Explosives remaining after the RI field activities are complete will be detonated on site.

1.5.10 UNANTICIPATED OR UNKNOWN WASTES ENCOUNTERED DURING THE PROJECT

During the course of an excavation or other work activity, unanticipated or sometimes unknown materials or indicators of unknown contamination may be encountered (i.e., strong odors or buried drums and cylinders). Some of these wastes potentially could be immediately harmful, and as such it is important for personnel to relocate to the extent necessary to allow a proper evaluation of the potential hazards. Additionally, wastes that may have been left behind by other personnel should be approached with reasonable caution and left alone until materials are evaluated and proper disposal is determined.

The safety procedures and/or emergency procedures and notification protocols identified in the SHSP should be followed when unknown wastes or odors are encountered or are otherwise not identified in this plan or scope of work. The Navy and USAE will develop a plan to deal with the waste materials before proceeding, and will implement the RCRA generator standards and determine suitable accumulation areas, should the waste be hazardous.

1.5.11 HAZARDOUS MATERIAL (INCLUDING WASTE) TRANSPORTATION

Hazardous materials must be shipped in accordance with DOT requirements. Hazardous material transported through the United States by land, by air shipment, or by vessel must be properly classed, described, packaged, marked, and labeled for shipment as required by the DOT Hazardous Materials Regulations 49 CFR 172.

In addition, samples that are sent to an off-site laboratory may also be considered DOT hazardous material, depending on what the sample is and what preservative chemicals are used (i.e., nitric acid, methanol, and acetone). If samples are (or are tentatively identified as being) DOT hazardous materials, the samples must be properly packaged, labeled, and the proper shipping papers must be provided for transportation to the laboratory. Air shipment requires different procedures than other modes of transportation, including specific requirements of the airline that must be followed. Packaging, labeling, and documentation requirements for samples collected at WVIA are discussed in the MC SAP. All air shipments of DOT hazardous materials will comply with International Air Transport Association requirements for transport by air.

All waste characterization information, including analytical results or generator name/ number (whether hazardous or non-hazardous), user knowledge used to perform the waste characterization, copies of waste profile sheets, waste permits, manifests, and other pertinent paperwork, will be retained in project files and will be turned over to the generator (Navy). Similarly, MD that has undergone treatment (if required) and has been certified and verified to be safe will be packaged (to prevent commingling with noncertified MPPEH), sealed, and shipped off site for demilitarization and recycling. Nonhazardous manifests will accompany the shipment of the MD.

1.6 RELEASE PREVENTION

1.6.1 ESTABLISHMENT OF BEST MANAGEMENT PRACTICES

Best Management Practices (BMP) will be implemented during fueling of equipment and for the storage and handling of recovered fuel product, contaminated soils, solid or hazardous waste materials, and/or other hazardous materials that are stored or used on site in support of project operations.

This plan also includes general BMP that will be implemented during project activities to protect adjacent land or surface waters from stormwater runoff that could cause sediments or contamination to migrate during project activities.

Throughout the duration of project activities, spill prevention will be addressed by familiarizing the crew with this EPP. Each task will be evaluated carefully to determine the potential for causing a spill before beginning the task. When spills are likely possible (such as during refueling, transferring of liquids to and from treatment system, or excavating contaminated soils from trenches), appropriate precautions will be taken to minimize potential spills as described below.

1.6.2 GENERAL BMPS AND PROTECTIVE MEASURES TO BE IMPLEMENTED ON SITE

Good housekeeping practices, as well as other preventive measures and BMPs on the project site and material/waste storage areas, will help maintain a clean and orderly work environment. Inspection and maintenance activities and good housekeeping practices will minimize the possibility of accidental spills and releases. Good housekeeping practices will allow for easier observation of potential releases including damage or wear and tear on equipment and storage containers. Regular inspections and maintenance of equipment and site facilities provide additional opportunities for detecting potential releases and addressing problems before a release occurs. A clean work environment will also reduce safety hazards to personnel. Table 1-3 summarizes the general hazardous materials and petroleum storage and handling BMPs to be employed at the site, as well as outlining protective measures. Table 1-4 provides a summary of general stormwater BMPs, and Table 1-5 provides the inspection requirements and frequency.

Table 1-3: Summary of General Hazardous Materials and Petroleum Storage and Handling BMPs

Best Management Practices	Description of Activities
Good housekeeping	Drip pans or equivalent will be used under vehicles or other fuel-driven equipment (i.e., generators) to collect leaking fluids during fueling or fuel transferring activities.
	Garbage and waste materials or debris will be regularly picked up and disposed of properly.
	Spill kits containing the proper type and quantity of sorbent materials, booms, and tools will be staged in each work area where there is a potential for a spill or release.
Inspections and maintenance	Equipment will be operated and maintained in accordance with manufacturer's recommendations.
	Hazardous material storage areas will be inspected at least weekly.
	Vehicles or other equipment found to be leaking will be repaired immediately or removed from the site.
	Monthly inspections of spill-response and fire-prevention equipment will be performed.
	Regular housekeeping inspections will be conducted daily, and the site will be maintained in an orderly fashion.
Container	Hazardous materials will be placed in suitable containers and storage areas that are in good condition. Hazardous wastes (if generated) will be stored in accordance with

management	regulatory requirements. A flammable storage locker will be used for small containers of flammable materials.
	Containers will be kept closed except when being filled/used and will be in good condition.
Training	Personnel will be trained in hazard communication (hazcom), spill prevention, response, and reporting requirements outlined in this EPP, stormwater pollution prevention requirements, and hazardous material storage and handling requirements.

Table 1-4: Summary of General Stormwater BMPs

Best Management Practices	Description of Activities
Good housekeeping	During excavation of any contaminated soils, care will be taken not to “off-track” contaminated soils from disturbed areas (in equipment tracks, tires, or buckets).
Good housekeeping	Soil- or mud-contaminated equipment (regardless if clean soil or contaminated soil) will be decontaminated (wiped or scraped clean of mud, soil, or debris) before moving to another location or storage between shifts.
Material storage	Hazardous materials and contaminated debris will be stored in a manner that does not contribute contaminants to stormwater (i.e., from rain or wind dispersal).
Soil stockpile management	Soil stockpiles (if they will remain longer than a single shift) will be maintained to prevent contaminant or leachate runoff or erosion from rain.
Good housekeeping	Fugitive dusts will be controlled as needed by using water spray to wet down soils being excavated or roadways used on the site.

Table 1-5: Inspection Requirements and Frequency

Inspection	Minimum Frequency	Checklist Form from Appendix A
Stormwater BMPs	Weekly during site activities and after major storm events	Stormwater BMP Checklist
Spill prevention, response, and emergency equipment	Monthly for the project	Spill Prevention, Response, and Emergency Equipment Checklist

1.6.2.1 Preventive Maintenance

Preventive maintenance involves the routine inspection and testing of equipment and is essential to keep vehicles and earthmoving equipment in good working condition. Operators of vehicles and machinery will inspect them at the beginning of each work day. Any deficiencies will be brought to the attention of the Site Superintendent who will ensure required repairs are made before it can be dispatched again. The Site Superintendent (or designee) will maintain records of inspections and maintenance.

1.6.2.2 Visual Inspections

The Site Superintendent or authorized designee will conduct visual housekeeping inspections of work or storage areas on a daily basis. The Site Superintendent will verify daily equipment inspections were completed and ensure that deficiencies are corrected.

1.6.2.3 Hazardous Material Management

Project vehicles will refuel at local gas stations. Small amounts of hazardous materials stored on the work site for operations (small gas cans, oils, lubricants, etc.) will be stored in a flammable materials locker when not in use. Hazardous material inventory control will be maintained for all hazardous materials brought to and stored at the site. MSDSs for each hazardous material will be maintained at the project site.

1.6.2.4 Excavations

Drainage of the target areas is towards Waikane Stream. Slope of the terrain is up to 30 percent at some points, resulting in a moderate to severe erosion hazard. Waikane Stream will be protected from the effects of sedimentation and contamination from stormwater runoff during the project. Excavations will be backfilled as soon as possible to 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. Heavy equipment will not be used.

1.6.2.5 Vegetation Clearance

Vegetation removal is in accordance with SOP 8 Vegetation Removal, Appendix B MEC SAP.

2.0 REFERENCES

The following are references applicable to this project, but are not all-inclusive. USAE will comply with applicable Federal, State, and local requirements. Following all applicable requirements and regulations listed in the following publications will ensure the safety and health of onsite personnel and the local community.

2.1 FEDERAL REGULATIONS

- Code of Federal Regulations (CFR)
  - 33 CFR 320 Wetlands Protection Act
  - 40 CFR Part 261.23 Resource Conservation and Recovery Act.
  - 43 CFR Part 7.4, 7.5 Protection of Archaeological Resources
  - 43 CFR Part 10.4 Native American Graves Protection and Repatriation
  - 49 CFR Parts 100-199 Transportation.
  - 62 Federal Register 6622, 1997 Military Munitions Rule.
- Fish and Wildlife Coordination Act 16 U.S.C. 661 et seq.
- Endangered Species Act 16 U.S.C. 1531-154.
- Migratory Bird Treaty Act 16 U.S.C. 703-712.
- National Historic Preservation Act 16 U.S.C. 1470.
- Clean Water Act 33 U.S.C. 1151 et seq., 1251 et seq., 40 U.S.C. 3906 et seq.

2.2 OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION

- Occupational Safety and Health Administration (OSHA) 1994 *General Industry Standards*, 29 CFR 1910 and *Construction Industry Standards*, 29 CFR 1926; especially 1910.120/29CFR 1926.65-*Hazardous Waste Site Operations and Emergency Response*.

2.3 NAVY REGULATIONS AND INSTRUCTIONS

- NAVSEA OP 5, Volume 1, with Change 7, dated 1 July 2008. *Ammunition and Explosives Ashore.*
- *Environmental Restoration Program Manual,* 2006.

2.4 STATE OF HAWAII GUIDANCE AND REQUIREMENTS

- HAR 11-451-15 *Hawaii State Contingency Plan*
- Hawaii Department of Health, 2008. *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater*

2.5 DEPARTMENT OF DEFENSE PUBLICATIONS

- DOD 6055.9-STD, *Ammunition and Explosive Safety Standards*
- DDESB TP-18, *Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel*

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APPENDIX H

H. ARCHAEOLOGICAL MONITORING PLAN

This appendix contains the archaeological monitoring plan for the Munitions Response Site at the Waikane Valley Impact Area.

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Final Report

Archaeological Monitoring Plan in Support of Unexploded Ordnance (UXO) Removal During Remedial Investigations at the Waikane Valley Impact Area, Kāne`ohe, Island of O`ahu, State of Hawaii TMK: 4-8-14:006

Prepared for:
Department of the Navy
Naval Facilities Engineering Command, Pacific
Pearl Harbor, Hawai`i 96860-7300

Contract Number: N62742-07-A-1907
Call Order Number: 002

November 2009

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FINAL REPORT
Archaeological Monitoring Plan in Support of Unexploded Ordnance (UXO) Removal During Remedial Investigation at the Waikane Valley Impact Area
Kāne`ohe, Island of Oahu, State of Hawaii
TMK 4-8-14:006

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Prepared for
Department of the Navy
Naval Facilities Engineering Command, Pacific
Pearl Harbor, Hawaii, 96860-7300

Contract Number N62742-07-A-1907
Call Order Number: 005

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November 2009

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INTRODUCTION

Under contract to the US Navy Facilities Engineering Command (USNAVFAC) (Contract No. N67242-07-A-1907, Call Order 005), Pacific Consulting Services, Inc. (PCSI) has prepared this archaeological monitoring plan (AMP) in support of Ordnance (UXO) Removal During Remedial Investigation in the Waikane Valley Impact Area (WVIA) on O`ahu. The archaeological monitoring work will be carried out in accordance with the provisions of the Antiquities Act of 1906, Section 106 of the National Historic Preservation Act (NHPA), 1966, As Amended, the Archaeological Resources Protection Act of 1979 (ARPA), and ARPA implementing regulations (32 CFR Part 229). Accordingly, this SOW is considered to be the equivalent of a federal permit as described in these statutes and regulations.

PROJECT AREA LOCATION

The WVIA is a 187-acre (75.7 hectare) portion of Waikāne Valley in the Ko`olaupoko District of the Island of O`ahu (Figure 1). Owned by the U.S. Government and designated TMK: (1) 4-8-014:006, the WVIA is located about 1.5 – 2.5 km inland of the shoreline in Waikāne Ahupua`a. An *ahupua`a* is a primary unit of land in Hawai`i, usually (though not always) extending from the uplands to the ocean (Lucas 1995).

GENERAL PROJECT DESCRIPTION AND SCOPE OF WORK

USA Environmental, Incorporated (USAE) completed a Site Inspection of the WVIA in 2008 in order to determine the nature and locations of the associated threats with respect to past use of munitions and explosives of concern (MEC) and Munitions Constituents. The subject undertaking, Remedial Investigation, will address MEC that were identified during the 2008 Site Inspection. Required actions will include removal and detonation or Blow in Place (BIP) of UXO.

According to the Scope of Work (SOW) dated February 20, 2009 (SOW: BX-09A), archaeological monitors will accompany inspection teams in order to conduct archaeological monitoring during ground disturbing and vegetation clearance as permitted by Explosives Ordnance Disposal (EOD) team. For safety reasons, the archaeologists will not permitted to be on site during UXO removal. The work is expected to be conducted by two teams. One archaeological monitor will accompany each team as safety permits.

Should any archaeological sites, features, deposits, or objects be found during the monitoring work that have not been previously recorded, the archaeological monitors will record their location with Global Positioning System (GPS) equipment such that the GPS data conform to the USMC’s standards for geospatial data as specified in the Draft US Marine Corps Data Management Guide. In addition, if any historic sites or cultural materials are exposed due to BIP operations, the archaeological monitors will document the exposed sites and collect the cultural materials.

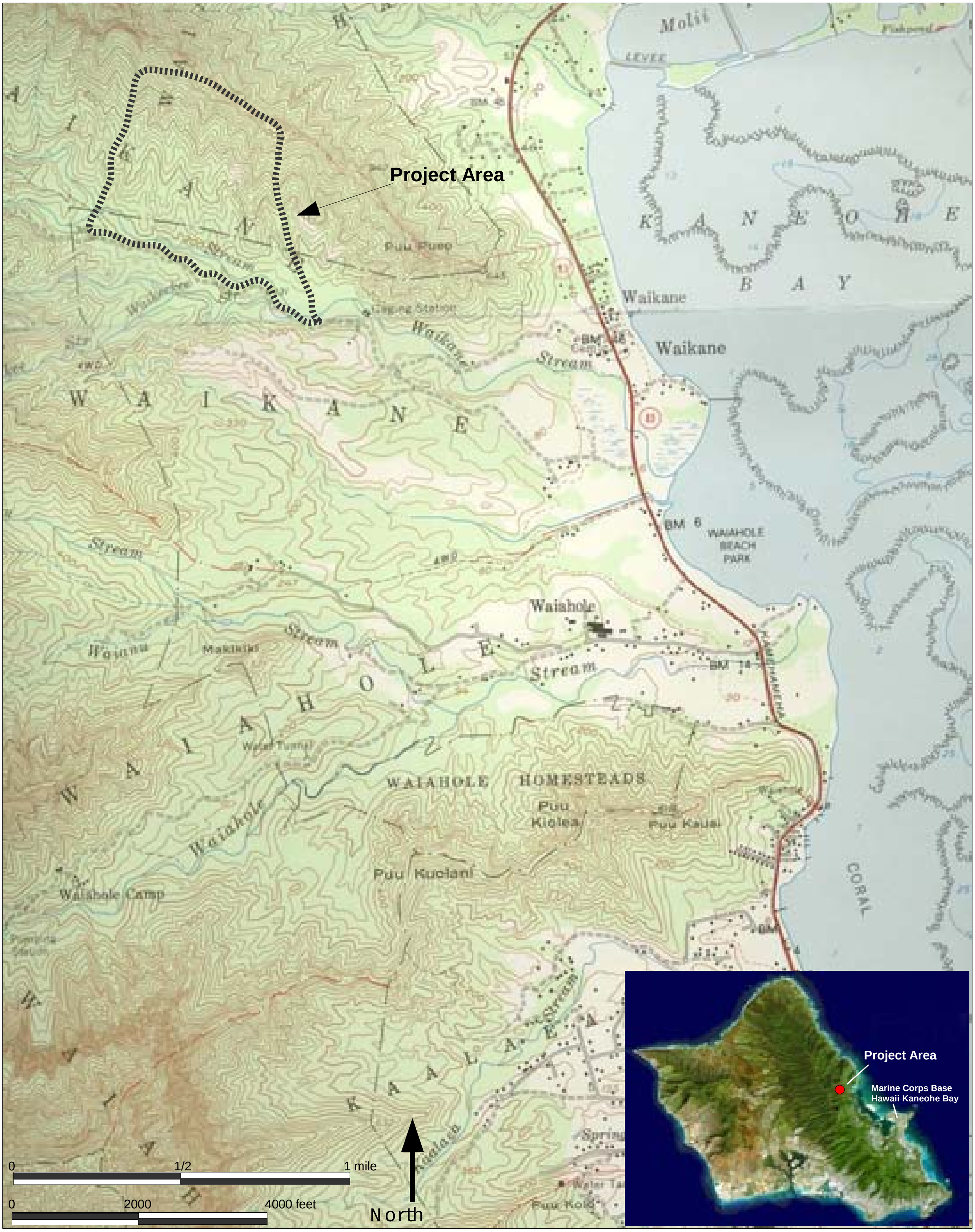

Figure 1. Project Area Location on U.S.G.S. Kahana and Kaneohe Quadrangle (1983).

ARCHAEOLOGICAL MONITORING QUALIFICATIONS

Archaeological monitors from PCSI will include one (1) individual meeting the qualifications of a field director staff with not less than 10 years of experience conducting archaeological activities in Hawai`i and two technicians with a minimum of five years of experience in conducting archaeological activities in Hawai`i. All PCSI field personnel shall be certified in Hazardous Waste Operations and Emergency Response (HAZWOPER) and will carry proof of HAZWOPER certification.

DELIVERABLES

According to the contract (N62742-07-A-1907), the following deliverables are expected as work products:

1. A draft archaeological monitoring plan will be submitted within 15 days of the contract award.

2. A final archaeological monitoring plan will be submitted within 7 days of receiving government comments on the draft archaeological monitoring plan.

3. An end of field work summary report will be submitted within 14 days of the completion of field work.

4. A draft report shall be submitted within 60 days of calendar days of the completion of field work

5. A final report shall be submitted within 45 days after the receipt of review comments from the US Government.

At the end of the project, all original field notes, photographs, maps and other appropriate documents and data will be transmitted to the USMC for archiving, and any recovered artifacts or other cultural items will be turned over to the USMC for disposition.

ENVIRONMENTAL BACKGROUND

GEOLOGY AND TOPOGRAPHY

Waikāne Valley is on the windward side of O`ahu and the Ko`olau Mountain Range. Formed by the Ko`olau Volcano, the Ko`olau Range was built through successive eruptions along a northwest-trending rift zone (MacDonald & Abbott 1970). The basalt formations of the Ko`olau Range have subsequently weathered into various soils types. In the project area, the predominant soil types, as determined by Foote et al. (1972), are Rock Land (rRK), where exposed rock covers 25 to 90% of the ground surface, and Waikane Silty Clay (WpE), found on alluvial fans and terraces.

Elevation in the project area ranges from 90 to 275 meters (m) above mean sea level (mamsl). The Waikāne Stream drainage, the gradually sloped land adjacent to it, and the steeper upper slopes farther away from the stream are the principal landforms.

RAINFALL AND HYDROLOGY

Located on the windward side of O`ahu, Waikāne Valley is wetter and experiences a higher annual rainfall than leeward areas, due to its proximity to prevailing trade winds and the "orographic effect" wherein rainfall increases with the elevation on the windward sides of mountains. In the vicinity of the project area annual rainfall ranges from 2,000 to 3,000 millimeters (Giambelluca et al. 1986).

The principal drainage of the project area is Waikāne Stream, which flows parallel to the southern boundary of the project area. Another tributary stream – Waike`eke`e Stream – drains into Waikāne Stream near the southeastern corner of the project area.

VEGETATION

The project area is heavily vegetated by a mixture of indigenous and exotic taxa. In addition to species such as *hau* (*Hibiscus tiliaceus*) and *hala* (*Pandanus odoratissimus*), which have formed very dense stands in many areas, more recently introduced agricultural taxa such as varieties of ornamental gingers (*Hedychium* spp.) and guavas (*Psidium* spp.) are present in abundance. Some of the endemic species still found in Waikāne Valley, as recorded in Walker and Rosendahl (1990) include *`ōhi`a lehua* (*Metrosideros collina*), *naupaka-kuahiwi* (*Scaevola gaudichaudiana*), *koa* (*Acacia koa*), and *pūkiawe* (*Styphelia tameiameiae*). In addition to these taxa – many of which are typically found in wet valleys like Waikāne – there are introduced grasses and shrubs.

HISTORICAL BACKGROUND

LEGENDARY HISTORY

The place name of Waikāne is a shortened form of the phrase Wai-a-Kāne or Kāne's water, literally (Pukui et al. 1984). The deity Kāne is closely linked to the place of Waikāne in legends associated with the area, and they are identified in such traditional lore as the Kumulipo creation chant (Beckwith 1976). Handy and Handy (1972) include a legend in which Hi`iaka, passing by Waikāne in a canoe, recounts Kāne's creation of male (Wai`ola-li) and female (Wai`ola-la), as he dug for water in the valley. Persons of renown associated with Waikāne include the chief Laka, said to reside at Hale`ula in Waikāne Valley (Sterling and Summers 1978), and the chief Maui, credited with the building of a zigzag road (Kamakau 1992). In addition to these associations, Kamakau (1992) also states that the *ahupua`a* of Waikāne was known as a *pu`u honua*, or place of refuge where persons condemned to death could be saved if they entered its lands.

TRADITIONAL AND HISTORICAL LAND USE

Although Waikāne Valley is not as broad or large as some of the neighboring lands such as Waiāhole or He`eia, it was known for the production of fine Ko`olau taro (Handy & Handy 1972). The most numerous and largest historic sites in the project area are complexes of taro *lo`i* or pond fields, and *`auwai* or irrigation ditches. McAllister (1933) recorded several *heiau* in Waikāne Valley only one of which survives – Kukuianiani, at the *makai* end, just inland of the highway. A *heiau* is a traditional Hawaiian site of worship; *makai* means seaward or toward the sea (Pukui and Elbert

1986). Other historic sites known from Waikāne include Pokole Fish Pond, near the mouth of Waikāne Stream (McAllister 1933).

Beginning in 1848, land ownership in Hawai`i underwent a profound change through implementation of the Great Mahele whereby the land – traditionally held by the monarch, high-ranking chiefs, and their retainers – was redistributed to eligible claimants by the Board of Commissioners to Quiet Land Titles or Land Commission (Chinen 1978). None of the 20 Land Commission Awards (LCAs) for Waikāne that were given to successful claimants during the Māhele of the A.D. 1850s is in the current project area; all of them lie *makai* of the WVIA, and most are within a kilometer of the shoreline. Nonetheless, the claimants' descriptions of their properties make clear the primacy of taro cultivation and associated agricultural practices. Although they were not listed among the Mahele claimants, the Kamaka family eventually acquired the land of the project area, and raised taro and conducted other agricultural activities on the property.

At about the time of the overthrow of the Hawaiian monarchy in 1893, L.L. McCandless sought the purchase or lease of Public Lands in Waikāne and Waiahole Valleys. By the beginning of the 20th century he had secured the desired property and commenced the construction of a large water transport system – called the Waiahole Ditch and Tunnel System – to convey water from these wet, windward valleys to the leeward plantations (Tuggle et al. 1998). McCandless also acquired title to or control over remaining government lands in Waikāne by the early 20th century, including much of the property held by the Kamaka family (Tuggle et al. 1998).

Also, by the late 19th and early 20th centuries, Chinese immigrants had settled throughout much of Waikāne and had established extensive rice cultivation fields, either adapting existing taro *lo`i* systems or constructing newer extensions of them (Griffin & Pyle 1974). After rice fungus blighted or wiped out much of the crop in the region, the Chinese abandoned rice farming and by 1925 had moved away from the area.

RECENT LAND USE HISTORY

According to Maly's (1998) summary, at the beginning of World War II (WW II), the United States (US) Army leased the project area and much of Waikāne Valley for training purposes. The lease was executed and the land used as a live fire range through 1961. At that time, the US Marine Corps (USMC) assumed the Army lease and continued use of the area for small unit tactical training through 1976 when they terminated the lease.

PREVIOUS ARCHAEOLOGICAL STUDIES

A number of specific archaeological studies and broader surveys have been undertaken in and around the project area during the past 30 years. Table 1 below lists the relevant archaeological studies. Figure 2 shows the location of archaeological sites in the WVIA (modified from Magnuson et al. 2004).

Prior archaeological work in and around the WVIA has documented the presence of extensive taro agricultural complexes, such as Statewide Inventory of Historic Places (SIHP) No. 1078 also listed on the National Register of Historic Places (NRHP) as the

Table 1: Chronological List of Relevant Archaeological Studies for WVIA

Year & Author	Nature of Work & Results
Welch & Streck 1984	Documentation of shrine (SIHP* No. 2889) within WVIA; contains additional data on SIHP Nos. 1078 & 2890
Shapiro et al. 1988	Reconnaissance survey of adjacent parcels; included pedestrian survey & subsurface testing; 29 archaeological sites recorded including agricultural, religious, habitation, and burial features
Walker & Rosendahl 1990	Intensive survey of a proposed fence line corridor around the WVIA; documented new features of a known site & two new sites
Dunn et al. 1992	Inventory survey of adjacent parcels for proposed golf courses; 13 archaeological sites recorded, including agricultural, charcoal production, habitation, and military features
Tuggle et al. 1998	Integrated cultural resource management plan; overviews of history, cultural and archaeological resources
Magnuson et al. 2004	Survey of WVIA, evaluation of sites, revision of site descriptions & classifications; traditional cultural property (TCP) assessment; oral history
Rasmussen 2006	Survey & monitoring of the former Waikane Valley Training Area, adjacent to WVIA; two new sites (*lo`i* & a military feature) and additional features of known sites were documented
Nees & Collins 2009	Archaeological monitoring of site inspection activities in the WVIA; one apparently modern cultural feature documented.

*SIHP = Statewide Inventory of Historic Places

Waikane Taro Flats, and SIHP No. 2890. The *lo`i* (taro pond fields) and *`auwai* (irrigation ditches) that are features of these sites are found on the stream flats on either side of Waikāne Stream as it descends through the valley. Both sites have undergone modern alterations, probably by 20th century truck farmers, who have enlarged the *`auwai* and *lo`i* and constructed charcoal kilns for processing wood charcoal for sale (Magnuson et al. 2004).

The Traditional Cultural Property (TCP) study carried out by Magnuson et al. (2004) yielded important information on historic properties that are significant to the Native Hawaiian community that has resided for generations in Waikāne. A TCP is a historic property that plays a significant role in a community's historically based beliefs, practices, and history; a TCP may or may not be altered through human agency and may be a solely natural feature (NRHP 1990). SIHP No. 6551, the Wai-a-Kāne Spring, was identified by Magnuson et al. (2004) with the assistance of local informants who participated in the oral history work conducted in support of the project.

Most recently, archaeological monitoring was carried out in support of investigation and sampling activities in the WVIA (Nees & Collins 2009). One new cultural feature was found by the archaeological monitor while accompanying the USAE team on a survey transect in one of the side gulches perpendicular to, and approximately 150 m north of, Waikāne Stream. The new feature consisted of a presumably modern petroglyph found on a large boulder in the middle of the gulch drainage. The petroglyph was found on the south side of the boulder, and consists of

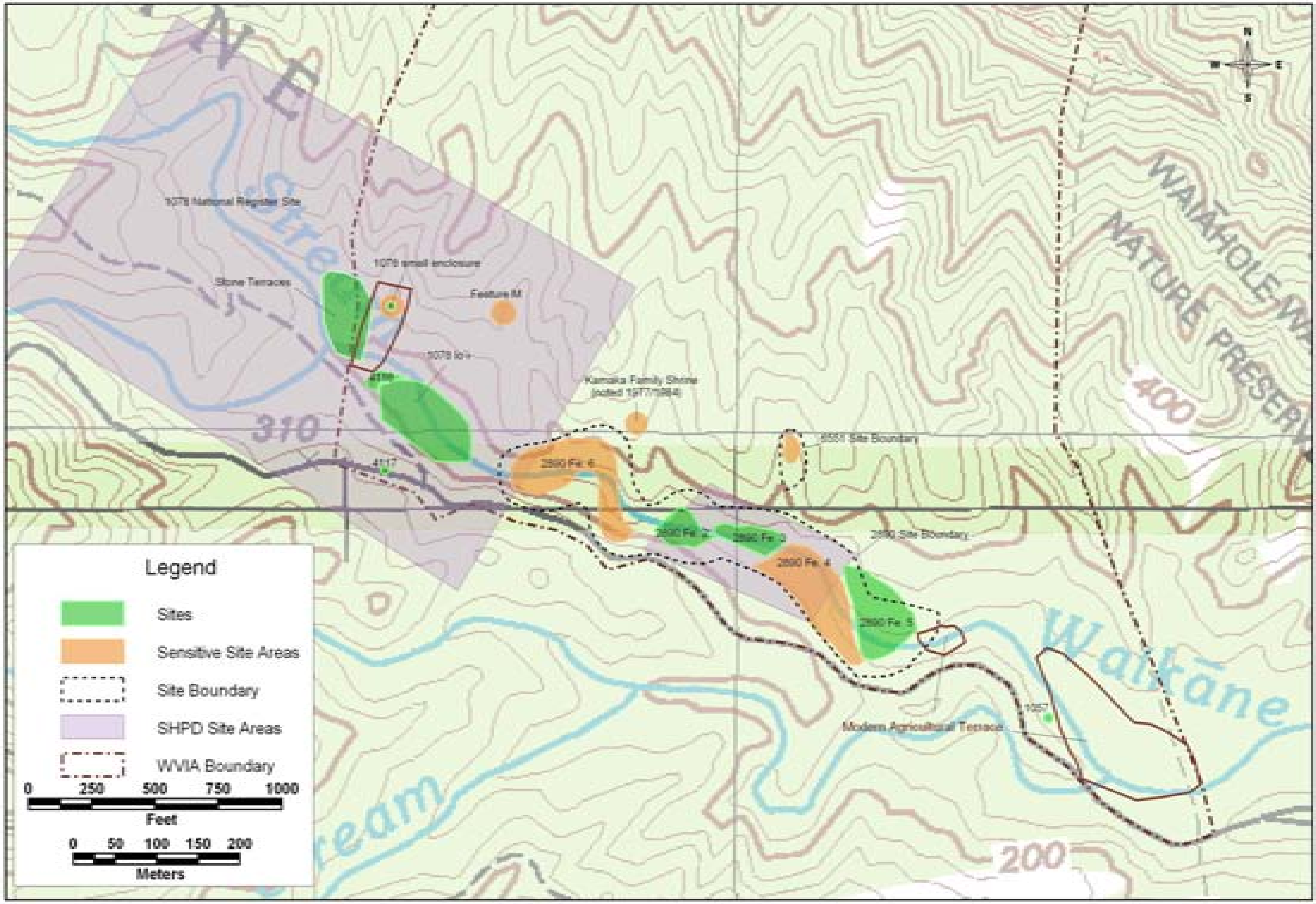

Figure 2. Location of Sites Identified During Waikane Valley Impact Area Site Assessment (Modified from Magnuson et al. 2004).

four pecked letters: S.T.K.K. Additional letters appear to the left of the S but were not legible. This site is of uncertain age and therefore a feature number was not assigned.

Although limited subsurface testing has taken place within the WVIA, adjacent areas – owned by private and public entities – have recently been investigated by the US Army Corps of Engineers in order to evaluate the presence and extent of any ordnance or other hazardous materials (Rasmussen 2006). Soil sampling during these investigations revealed the presence of charcoal deposits, presumably cultural in origin, in several locations in the study area. Additionally, isolated artifacts have been found in the WVIA. The most recent study within the WVIA (Magnuson et al. 2004) recovered items such as a poi pounder and a basalt flake during the field work.

ARCHAEOLOGICAL MONITORING PLAN

GENERAL PROCEDURES

According to the Scope of Work (SOW) dated February 20, 2009 (SOW: BX-09A), archaeological monitors will accompany inspection teams in order to conduct archaeological monitoring during ground disturbing and vegetation clearance as permitted by Explosives Ordnance Disposal (EOD) team. The SOW calls for the inspection to be conducted by two teams, each accompanied by an archaeological monitor. For safety reasons, the archaeologists will not permitted to be on site during UXO removal. The work is expected to be conducted by the two teams over a period of approximately three weeks. The USAE team expects to work ten-hour workdays, four days per week Monday through Thursday, with Friday reserved as a make-up day in case of bad weather.

Information from previous archaeological and cultural studies will be used to identify site locations and sensitive areas. Should additional, substantive information on historic sites or sensitive areas become available through the consultation process, it will be incorporated into the monitoring program. Prior to beginning fieldwork, monitors, a briefing will be conducted on site by PCSI that will include PCSI archaeological monitors. UXO technicians and inspection team members in order to explain monitoring procedures, and alert the UXO and inspection teams to the types of sites or finds expected during the investigation.

SITES IN THE PROJECT AREA

The sites present in the WVIA Area of Potential Effect are shown in Figure 3. As outlined above, previous archaeological surveys have identified five historic sites within the WVIA that are listed in Table 2 (from Magnuson et al. 2004: 27-33 and Nees and Collins 2009) below.

The sites listed in Table 2 represent a sample of sites typically found in Waikāne Valley from the pre-Contact era through the modern era. The sites include the following:

Table 2: List of Historic Sites Documented in WVIA During 2004 Survey.

SIHP*	Type of Site	Site Function(s)	No. of Features	Status
1057	Alignment	Unknown	1	Site destroyed
1078	Waikāne Taro Flats	Taro cultivation & habitation	3	Some modern alterations; on NRHP; preserved
2889	Cairn & terraces	Religious	1	Eligible for listing on the NRHP; preserved
2890	Lo`i, `auwai, hanau stone	Agricultural, religious	6	Eligible for listing on the NRHP; preserved
6551	Wai-a-Kāne Spring	Traditional Cultural Property	1	Eligible for listing on the NRHP

*SIHP prefix is 50-80-06-)

- SIHP No. 1057: Now largely destroyed, SIHP 1057 was previously described as having four (4) features near Waikāne Stream: a large enclosure, a possible enclosure, a small paving, and a feature of indeterminate description. In 2004 (Magnuson et al.), a small alignment of five (5) boulders was recorded that may be a remnant of one of the enclosures; all other features appear to have been destroyed through stream flooding or bulldozing. The remnant portion of SIHP No. 1057 is about 1.5 m in length.
- SIHP No. 1078: the Waikāne Taro Flats was placed on the National Register of Historic Places (NRHP) in 1973. The site consists of large complex of contiguous taro *lo`i* and *`auwai*, and includes habitation areas; its condition and preservation are better *mauka* (inland) and outside of the WVIA. The features of SIHP No. 1078 within the WVIA include the following: Feature A (a taro *lo`i* modified in the 1960s by a Waikāne resident) that is about 120 m northwest to southeast and 50m southwest to northeast; Feature L (a C-shaped structure built of stacked boulders) about 3.0 by 3.0 m in size; Feature M (a C-shaped structure built of stacked boulders) about 4.0 by 4.0 m in size.
- SIHP No. 2889: The site consists of rock-lined terraces and a shrine. The shrine is built of two naturally occurring large boulders with a capstone placed upon them; a small cupboard is present in the area below the capstone. The rock-lined terraces are near the shrine on the same slope and, although partially disturbed, consist of alignments of cobbles and boulders. The entire site area is approximately 20.0 by 20.0 m while the shrine feature is approximately 2.1 by 3.0 m in size.

  SIHP No. 2890: The site's six (6) features consist of six (6) contiguous alluvial terraces along Waikāne Stream. Each alluvial terrace includes a series of agricultural terraces. Although portions have been modified due to recent agricultural activities, it is likely that the site dates back to pre-Contact times. Wai-a-Kane Spring and a Hanau Rock (birthing stone) are located within or adjacent to SIHP No. 2890; the spring is on the slope above Feature 4 while the Hanau Rock is within it. The six (6) features occupy an overall area of 950 m along Waikāne Stream by about 120 m in width.

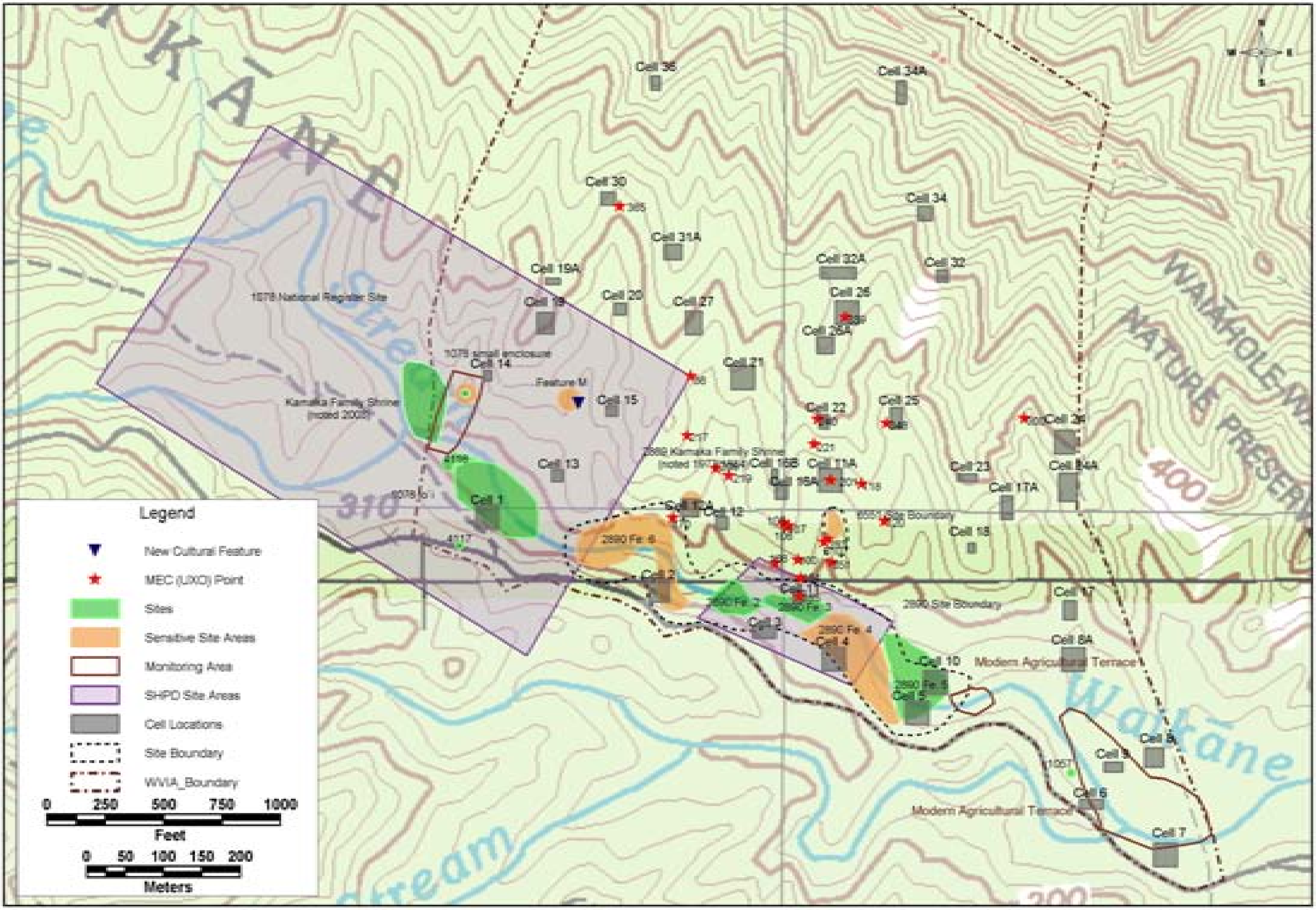

Figure 3. Location of MEC (UXO), Cells, and Archaeological Sites within the Project Area.

- SIHP No. 6551: Wai-a-Kāne Spring has been designated a TCP. It is a naturally occurring spring on the slope above Feature 4 of SIHP No. 2890; there may be some human modifications of the stream course as it proceeds downslope to Waikāne Stream. Including the naturally formed pools and waterfalls, Wai-a-Kāne Spring extends about 100 m downslope to Waikāne Stream with a width of about 10 m.

In view of the results of prior studies, it is anticipated that the types of historic properties that may be found during the subject undertaking will fall into three categories: isolated finds of artifacts; subsurface cultural layers containing charcoal and/or midden deposits that are encountered during soil sampling work; additional surface features of known historic sites, such as additional pond field terraces or walls. The inadvertent discovery of historic burials is considered to be of low probability.

CLEARING PROCEDURES AND PRECAUTIONS

Figure 3 shows the location of known historic sites and cultural properties, and the locales of UXO identified during the 2008 Site Investigation (Nees & Collins 2009). The UXO locales are where vegetation clearing will likely occur. To the extent possible, historic sites will be avoided. No heavy equipment will be used. All vegetation clearing will be done by hand, primarily with machetes. Where needed, a chainsaw may be used to remove obstructing branches that are one inch or less in diameter. Cut vegetation will be removed from historic sites and placed in an adjacent area away from historic sites or deposits.

GENERAL SITE PROTECTION PLAN

In coordination with MCB Hawaii Cultural Resource Managers and USAE personnel, a general site protection plan for sites and features that may be impacted by blowing in place (BIP), or other removal actions of MEC, has been developed and is presented in this section. Individual site protection plans may be developed on a case by case basis, as appropriate, especially if more specific protection measures are needed that go beyond the general measures presented here.

Seven (7) of the numbered MEC items identified in Waikāne Valley are located within 235 feet (71.6 m) of known historic sites. Table 3 below lists these seven MEC items, and includes the site number of the nearest archaeological site, the site type, designations of features involved and their feature types, and the approximate distance (in feet) between the MEC and the nearest site or feature. Figure 3 above shows the MEC locations with respect to the archaeological sites.

Removal Procedures for MEC

Standard procedures for removal of MEC will include both blowing in place (BIP) and moving MEC items that can be safely relocated for consolidated detonation. In instances where MEC cannot be safely moved, USAE personnel will contain the blast by surrounding the MEC item(s) with sand bags or earthen berms in order to minimize the scatter of debris from the BIP. Additional material such as plywood may be added if necessary to protect sites. The archaeological monitor will not be permitted in the

Table 3. List of MEC Locales within Known Archaeological Sites.

MEC No.	MEC Within Site Boundary	Site No.	Site Type	Feature No.	Feature Type	Distance from MEC to Nearest Site
170	No	2889	Kamaka Family Shrine	1-6	Shrine	82 feet
170	Yes	2890	Agricultural terrace complex	6	Terraces	196 feet
283	Yes	6551	Waikāne Spring	1	Sacred water source	16 feet
310	Yes	6551	Waikāne Spring	1	Sacred water source	33 feet
351	Yes	6551	Waikāne Spring	1	Sacred water source	115 feet
164	On site boundary	2890	Agricultural terrace complex	3	Terraces	98 feet
165	Yes	2890	Agricultural terrace complex	3	Terraces	16 feet
166	On site preserve boundary	2890	Agricultural terrace complex	3	Terraces	131 feet
166	No	2890	Agricultural terrace complex	2	Terraces	196 feet

the exclusion zone during BIP activities, but will implement the following procedures prior to BIP of any MEC's located within 235 feet (71.6 m) of archaeological sites/features:

- Inspection of the immediate surroundings of the MEC locale to determine if any archaeological sites/features are in danger of being impacted by the BIP activities.
- Photographic documentation of site and feature condition near the MEC locale.
- Inspection of the site area near the MEC locale and comparison to the existing site plan to ensure that all features and surface artifacts are accurately recorded. If information is missing from the map, appropriate details will be added to the site plan.
- The MEC BIP location will be plotted on the site plan prior to BIP activities.

Should it be determined that the historic site located nearest to an MEC is vulnerable to damage from the BIP, further protection measures for the site/feature may be necessary. In these cases, the following procedures will be implemented under supervision of the archaeological monitor in consultation with USAE personnel prior to BIP activities:

- Determine appropriate quantity of sand bags and/or berms required for additional protection.
- Additional sand bags or berms will be placed on the ground surface or stacked up next to feature(s) that are determined to be vulnerable to the BIP.

Site Inspection Procedures

Upon completion of the BIP activities and after it is determined that safe access to the MEC and historic site is possible, the archaeological monitor will implement the following procedures:

- Inspection of the immediate surroundings of the MEC locale to determine if any archaeological sites/features were impacted by the BIP activities.
- Documentation of site and feature condition. If any damage to surface structures has resulted from the BIP, this damage will be photographed and described in detail, and plotted on site plans; MCB Hawaii Cultural Resource Managers will be notified if damage to sites occurs (damage is defined here as displaced, broken, or scarred feature rocks, and disturbance of subsurface cultural materials and features).
- Documentation of the process of filling in the crater caused by the BIP. This will include photographs and descriptions of the nature (texture, color, inclusions) of the soils/sediments used for the fill.
- Documentation of any cultural materials (artifacts, faunal remains, floral remains) that may have been exposed by the BIP activities will include photographs and written descriptions. Collecting artifacts and other cultural materials exposed by

the BIP will be conducted in coordination with MCB Hawaii Cultural Resource Managers.

Documentation of Unrecorded Sites Prior to BIP Activities

If previously undiscovered historic properties are found in the immediate vicinity of an MEC that must be blown in place, the monitoring archaeologist will perform standard site recordation, including detailed mapping and photography before proceeding with Site Protection measures and BIP activities. Previously unrecorded sites will be reported to MCB Hawaii Cultural Resource Managers. The archaeological monitor will submit weekly (as appropriate) status reports to the Navy and to MCB Hawaii Cultural Resource Managers summarizing archaeological monitoring of MEC items that are blown in place. These reports will list BIP activities monitored and summarize impacts, if any, to archaeological sites.

Documentation of BIP Activities Outside of Archaeological Site Areas

The archaeologist will monitor all BIP activities that are located outside of defined archaeological site boundaries. This will entail examining the crater caused by the BIP to determine if subsurface cultural materials or features are present. If cultural materials and features are present, the monitoring archaeologist will follow the procedures for documenting unrecorded sites (see previous section), including standard site recordation, detailed mapping and photography, and notify the Navy and MCB Hawaii Cultural Resource Managers.

TREATMENT OF INADVERTENTLY DISCOVERED BURIALS

To the extent possible, any historic burials that are inadvertently discovered during the undertaking will be secured and preserved in place. If such burials are determined to be Native Hawaiian, the procedures outlined in §10.4 (Inadvertent Discoveries) of Subpart B of the implementing regulations for NAGPRA at 43 CFR Part 10 will be followed.

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FINAL
Explosives Safety Submission
Munitions Response Sites

WAIKANE VALLEY IMPACT AREA
KANEOHE, HAWAII

December 2009

Commander
Naval Facilities Engineering Command, Pacific
258 Makalapa Drive, Suite 100
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Contract Number N62742-05-D-1868, CTO 0010

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ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DDESB	Department of Defense Explosive Safety Board
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ESQD	explosive safety quantity-distances
ESS	Explosives Safety Submission
EZ	exclusion zone
ft	foot/feet
HFD	hazard fragmentation distance
IBD	inhabited building distance
MCE	maximum credible event
MDEH	material documented as an explosive hazard
MDAS	material documented as safe
MEC	munitions and explosives of concern
MFD	maximum fragment distance
MGFD	munition with the greatest fragmentation distance
MPPEH	material potentially presenting an explosive hazard
MRS	Munitions Response Site
NAVFAC	Naval Facilities Engineering Command
NEW	net explosive weight
NOSSA	Naval Ordnance Safety and Security Activity
PES	potential explosion site
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RI	Remedial Investigation
RPM	Remedial Project Manager
SUXOS	Senior UXO Supervisor
UXO	Unexploded Ordnance
UXOQCS	UXO quality control specialist

1.0 BACKGROUND

This Explosives Safety Submission (ESS) has been prepared for a Remedial Investigation/Feasibility Study (RI/FS) to address the past use of munitions and explosives of concern (MEC) and munitions constituents (MC) for a Munitions Response Site (MRS): the Waikane Valley Impact Area located at Kaneohe, Hawaii. This ESS is prepared in accordance with Naval Ordnance Safety and Security Activity (NOSSA) Instruction 8020.15B.

1.1 PROJECT MANAGER

The Navy Remedial Project Manager (RPM) is Mr. Lance Higa. Mr. Higa's contact information is:

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1.2 MRS IDENTIFIER AND DESCRIPTION

The Waikane Valley Impact Area (WVIA) MRS is addressed under this RI/FS. The MRS, identified as UXO-0022, is 187 acres in size and was once part of the 2000-acre Waikane Valley Training Area. Figure A-1 shows the MRS location and its relationship to the larger Waikane Valley Training Area which is being addressed by U.S Army Corps of Engineers (USACE) under the Formerly Used Defense Sites program (FUDS).

The WVIA MRS was originally a part of Waiahole Training Area, used by the U.S. Army from 1943 to 1953 for jungle training, field maneuvers, and small arms, artillery, and mortar firing. The U.S. Marine Corps (USMC) used 1061 acres from 1953 until the early 1960s for small arms fire, 3.5 inch rockets and medium artillery fire. WVIA is currently under control of Marine Corps Base Hawaii (MCBH) and is managed as an "other than operational range".

Four specific targets are identified as Areas of Concern (AOC) to be characterized for MEC as shown in Figure A-2. Table 1-1 provides information on the AOCs to be investigated, including identifier, name, historical use, size, and the MEC items historically encountered within the AOCs.

Table 1-1: Munitions Response Sites Considered for Investigation

AOC Identifier	Historical Use	Size (Acreage)	Encountered MEC & MPPEH items
AOC 1	Small Arms	1.8	Small arms, 3.5" rocket
AOC 2	Rockets, Rifle Grenades	7.9	2.36" & 3.5" rockets, rifle grenades
AOC 3	Rockets, Rifle Grenades	8.4	2.36" & 3.5" rockets, rifle grenades
AOC 4	Rockets, Rifle Grenades	5.1	2.36" & 3.5" rockets, rifle grenades

1.3 REGIONAL MAP(S)

Figure A-1 is a regional map of the WVIA showing its location on Oahu Island. Figure A-2 shows the boundaries of the AOCs that are being addressed under this RI/FS.

1.4 SCOPE OF MUNITIONS RESPONSE

The scope of MEC activities for the RI includes surface clearance of the 4 AOCs in order to determine horizontal extent of the target areas, subsurface clearance of 8 grids within each AOC in order to determine vertical extent and density of MEC within the targets, and subsurface clearance of a transect across the down-gradient end of AOCs 2, 3, and 4 to determine whether MEC has migrated due to erosion. Upon completion of the fieldwork a MEC hazard assessment will be completed in order to determine whether no further action is warranted or further remediation is necessary. The 4 AOCs are located largely on property that is only suitable for recreation. The goal of MCBH is to excess the MRS upon completion of remediation. No construction or other activities will occur on the MRS concurrent with the RI/FS activities.

1.5 HISTORY OF MEC USE

Between 1943 and 1953, the Army leased this property for maneuvers, jungle training, and small arms, artillery, and mortar firing. The USMC leased 1061 acres of the training area in 1953. Training consisted of small arms fire, 3.5-inch rockets, and possibly medium artillery fire. Live fire apparently stopped in the early 1960's. Due to fire hazards, incendiaries were prohibited and all ammunition in excess of .50 caliber was to be fired into the designated impact area. The lease was terminated in 1976 and returned to the original owners who farmed and developed it.

In 1944, four people were injured, two fatally, when a 60mm mortar discovered in Waikane Valley accidentally detonated. Three children were injured in 1963 when a souvenir rifle grenade reportedly discovered in Waikane Valley exploded after it was thrown against a wall. There are no other reports of fatalities or injuries attributable to MEC discovered at Waikane Valley.

The USMC conducted ordnance clearance sweeps in 1976 and 1984. The 1976 clearance effort resulted in the removal of over 24,000 pounds of practice ordnance and fragments, including 42 items of unexploded ordnance (UXO). The after action report stated that 187 acres of the WVIA can never be certified free of unexploded ordnance due to the ground cover and topography. In December 1983, heavy rain exposed ordnance on the property and Marine Explosive Ordnance Disposal (EOD) removed a number of 3.5-inch rockets. In January 1984, Marines conducted a sweep and removed 480 3.5-inch rockets. In June 1984, an intensive ordnance clearance resulted in the removal of 16,000 pounds of demilitarized practice ordnance and 190 items of UXO from the parcel. The after action report supported the conclusions of the 1976 report that the property could never be certified clear of ordnance.

In 1989, the government acquired title to the 187-acre ordnance contaminated area of the original WVIA. Fencing of the property was completed in 1992 and it remains as government property due to it being deemed improbable that it can be cleared of all ordnance contamination. The area is currently controlled and maintained by MCBH.

1.6 PREVIOUS STUDIES OF EXTENT OF MEC CONTAMINATION

1.6.1 RANGE INVESTIGATION AND PRELIMINARY RANGE ASSESSMENT/ARCHIVES SEARCH REPORT

The 187-acre MRS was identified for further evaluation as a result of a Range Investigation and Preliminary Range Assessment (RIPRA) and Archives Search Report (ASR) completed in 1998. MCBH contracted with U.S. Army Engineer District, Honolulu to prepare an Environmental Assessment (EA) to evaluate the effects of a Proposed Action of conducting non-live fire jungle orientation and maneuver training within the 187-acre property. The Proposed Action was cancelled in September 2004 after the Marine Corps determined that Waikane Valley is unsuitable for troop training because of safety concerns.

1.6.2 ENGINEERING EVALUATION/COST ANALYSIS

From June 2005 until May 2006, USACE conducted field work for an Engineering Evaluation/Cost Analysis (EE/CA), evaluating MEC risks over 874 acres of the FUDS portion of WVTA adjoining the southern and western boundaries of the MRS. The EE/CA consisted of evaluation of 150 grids (100 ft by 100 ft) and nine miles of transect. During the investigation, seven MEC items were recovered; two 81mm HE rounds, three 60mm HE rounds, and two 37mm HE projectiles. All of the MEC items were recovered in the southeastern portion of the FUDS site, which adjoins the southern boundary of the MRS. Projectile fragmentation, fuze pieces, tail fins, base plates, and other munitions debris were located throughout the valley.

1.6.3 SITE INSPECTION

Naval Facilities Engineering Command, Pacific (NAVFAC PAC) conducted a Site Inspection (SI) at WVIA from 29 September to 30 October 2008. An instrument-aided field reconnaissance survey was conducted to evaluate and document the presence of MEC, MC, or other munitions-related finds. The field teams surveyed 9.55 acres in transects and 5.2 acres within 42 cells, for a total of 14.75 surveyed acres.

The *Draft Final SI Report for Munitions Response Program, Waikane Valley Training Area* (August 2009) identified four target areas as AOCs and recommended an RI/FS. Many items of munitions debris (MD) were noted during the site inspection. Seventy MEC items were found, all fired and fuzed and therefore considered UXO. The UXO items included 66, 3.5-inch shoulder fired High Explosive Anti-Tank (HEAT) Rockets, one 2.36 inch shoulder fired HEAT Rocket warhead, and three HEAT Rifle Grenades.

1.7 JUSTIFICATION FOR NFA DECISION

Not applicable.

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2.0 PROJECT DATES

Field activities are projected to commence in January 2010 and 100% complete by the end of February 2010. Field work cannot start until this ESS is approved. Any delay in the approval of the ESS beyond the allotted 90 calendar days will delay the projected start date.

3.0 TYPES OF MEC OR MPPEH

3.1 TYPES AND QUANTITY OF MEC AND MPPEH

Table 3-1 lists the types and quantities of MEC and Material Potentially Presenting an Explosive Hazard (MPPEH) found during previous clearances and investigations of the MRS and areas immediately adjacent to the MRS.

Table 3-1: Previous MEC Encountered

Size	Nomenclature	Amount	NEW[1] (Lb.)	Type
MEC found during 2008 SI at WVIA				
75 mm	M28 HEAT	3	1.0	Grenade, rifle
2.36 inch	M6 HEAT	1	0.50	Rocket
3.5 inch	M28 HEAT	66	1.88	Rocket
MEC found during USACE EECA at Waikane Valley Training Area				
60 mm	M49A3 HE	3	0.42	Mortar
81 mm	M362A1 HE	2		Mortar
37 mm	MK II HE	2		Projectile
MEC/MD found during 1976 Surface Ordnance Sweep				
75 mm	HE	32		Projectile
60 mm	HE	9	0.42	Mortar
	M28 HEAT	1	0.75	Grenade, rifle
37 mm	HE	1		Projectile
	Munitions Debris	24,400 lb.		
MEC/MD found during 1984 Surface Ordnance Sweep				
3.5 inch	M28 HEAT	146	1.88	Rocket
2.36 inch	HEAT	24	0.50	Rocket
	M28 HEAT	11	0.75	Grenade, rifle
	M9A1 practice	9		
	M29 practice	87		
3.5 inch	Practice	3,770		Rocket
	Munitions Debris	16,000 lb.		

[1] NET EXPLOSIVE WEIGHT

3.2 MUNITIONS WITH THE GREATEST FRAGMENTATION DISTANCE (MGFD)

Based on the MEC items found during the SI, the 3.5-inch rocket is selected as the MGFD. A baseplate for a 75mm projectile was the only evidence of artillery activity discovered during the SI. The 1976 ordnance sweep appears to have addressed the entire Waikane Valley Training Area acreage, and it is probable that the 75mm projectiles found during that clearance were found outside of the WVIA MRS.

A contingency MGFD was selected for the AOCs because other munitions types were found on adjacent property during the USACE EE/CA, and during two previous surface ordnance sweeps. There is also some uncertainty that the selected MGFD absolutely reflects the MEC with the greatest fragment distance, since the WVIA AOCs have not been 100percent investigated. A contingency MGFD will allow work to continue safely if munitions found are larger than the primary MGFD, but smaller than the contingency MGFD. The contingency MGFD for all AOCs will be the 75 mm projectile. Table 3-2 provides the maximum fragmentation distance for the primary and contingency MGFDs.

Table 3-2: Primary and Contingency MFGD for MRS UXO 0022

MGFD Type	Munitions Item	MFD-H (ft)
Primary	3.5-inch HEAT rocket (2)	1,420 (1)
Contingency	75 mm HE projectile, M48 (2)	1,701 (1)

Table notes:

(1) From DDESB Fragmentation Database.

(2) High Explosive Anti-Tank (HEAT); High Explosive (HE).

If a MEC item is encountered during the investigation that has a greater fragment distance than the selected MGFD, but less than or equal to one of the contingency MGFD, the Project Manager will: (1) select from among the contingency MFGD a new MGFD that has a fragment distance equal to or greater than the newly-identified MEC item; (2) implement the increased protection required by the selected contingency MGFD; and (3) notify MARCORSYSCOM (2043) of the change in MGFD.

If a MEC item is encountered during the course of the investigation that has a greater fragment distance than the selected MGFD or the greatest contingency MGFD, the Senior UXO Supervisor (SUXOS) will immediately cease operations in that AOC. The SUXOS will then notify the Project Manager and RPM, who will submit an amended ESS to MARCORSYSCOM (2043). Work in that AOC may not continue until MARCORSYSCOM (2043) has approved the amended ESS.

3.3 MAXIMUM CREDIBLE EVENT

Not applicable

3.4 EXPLOSIVE SOIL AND CONTAMINATED BUILDINGS

Not applicable.

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4.0 MEC AND MPPEH MIGRATION

The target AOCs are located on steep slopes which have been severely eroded since previous military use. This erosion has caused local exposure and migration of MEC and MPPEH, but migration has not reached lower elevations of the site. The planned surface clearance will control migration of MEC and MPPEH, while the FS will address possibilities for managing future erosion. Due to the tropical climate, frost heave is not a MEC and MPPEH exposure mechanism.

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5.0 DETECTION TECHNIQUES

The surface clearance will be an instrument-assisted systematic surface clearance of 100% of the four AOCs and transect using analog detectors. If MEC is still being found as the boundary of a target area is reached, USAE will inform the RPM, and will continue surface clearance by stepping out 15 meters in any direction from where the last MEC item is found. In addition, the MEC Team will recover and dispose of the 70 MEC items discovered during the SI.

Subsurface investigation will consist of 100% investigation of all anomalies within 32 grids to target depths of two feet in planned recreational areas and four feet in planned residential/agricultural areas. Eight grids, each 1/16 acre in area (50 feet by 50 feet), will be established in each AOC. At least two grids will be located at the densest occurrence of surface MEC within the AOC, and the remaining six grids will be spread across the AOC to enable characterization of moderate and low density areas. A transect five feet wide and stretching across the southern end of AOCs 2, 3, and 4 will be subsurface investigated to a depth of four feet.

5.1 DETECTION EQUIPMENT, METHOD, AND STANDARDS

Selection of detection equipment is based on ease of operator use, detectability, and reliability in the steep terrain, rainforest climate, and dense vegetation at WVIA. The Schonstedt GA-52Cx magnetometer is lightweight and easy to use, has the capability of detecting the target munitions to their expected penetration depths, and holds up in rugged use.

After intrusive investigation of each grid and transect has been completed, Digital Geophysical Mapping (DGM) equipment will be used to provide a geophysical map of the grid or transect as a record of the analog intrusive action. The DGM data and processed map is not intended as a verification of clearance since this action is an investigation to determine extent and density of MEC within the grid or transect. Prior to use on the grids or transect, the DGM system (EM61-MK2, operators, and positioning system (traditional line/station/fiducials) will be demonstrated at an Instrument Test Strip (ITS).

The ITS will be established in a convenient location that simulates the conditions at the AOCs and permits efficient daily use. The selected location will be checked for background anomalies prior to any seed item placement. If necessary, the test area will be relocated to avoid background anomalies. The ground surface of the test area will be seeded with inert MEC items (or equivalent simulants) at various depths, orientations, and inclinations. The test area will consist of the following inert seed items, or their simulants: M9 rifle grenade, 2.36-inch rocket, and 3.5-inch rocket. Three (3) of each seed item type will be buried, one shallow (to confirm detection), and two deep (to establish maximum depth detection capability. Performance of the analog systems will be evaluated at the ITS. Settings will be optimized to detect the seed items. Any change to the established settings, needed to maximize the test strip detection results while minimizing background responses, will be documented and reported.

5.2 NAVIGATION EQUIPMENT, METHOD, AND STANDARDS

Handheld GPS equipment (e.g. Trimble GeoXH with external antenna or equivalent) will be used to establish approximate boundaries of the AOCs. A 5-meter external antenna cable will be used to extend the antenna as high as possible in the jungle canopy.

Since the surface clearance involves a step-out process to determine the horizontal extent of the AOC, final boundaries will not be established until the completion of the surface clearance. A Professional Land Surveyor will survey in the AOC boundaries and working grid corners to an accuracy of 0.1 foot. The grids established for subsurface investigations will be 50 feet by 50 feet. USAE personnel will record the location of any MEC within a grid using tape measures from the PLS established grid corners.

5.3 EQUIPMENT CHECKOUT

The ITS will be used as a function check area for daily certification of analog system operability. The ITS will use appropriate inert seed items or simulants in order to conduct a daily instrument functional test of the analog metal detector selected prior to the start of analog clearance operations. All UXO technicians will process through the ITS daily to demonstrated their ability and the instruments capability to detect all seed items. These daily checks will be monitored by QC personnel and the results documented. The ITS will also be used to demonstrate that DGM equipment, DGM operators, and DGM Data Processor/Analyst are meeting project Data Quality Objectives (DQOs), including performance metrics, data delivery, and documentation at the start of the DGM task. Additional in-process DGM QC checks to be conducted include blind seeding and daily static and dynamic performance testing.

Daily DGM checks include a morning and afternoon static check that includes 1 minute of background, I minute of spike response within +/- 10% of initial spike response on all channels, 1 minute of repeat background, 30 seconds of cable shake, and 30 seconds of operator check. A morning and afternoon dynamic Latency check is also performed over a known object in opposite directions. Daily DGM processing checks include Along-Line Measurement Spacing checks (98% <=25cm along line), survey Speed check (95% within maximum project design speed, as established/demonstrated at the ITS, Coverage checks (>90% coverage at the designed line spacing of 2.5 feet), and detection of all BSIs in grids or transect.

5.4 DATA COLLECTION AND STORAGE

When practicable, the UXO Team Leader (TL) will record recovered anomaly data on ruggedized Personal Digital Assistants (PDAs), using pull-down menus or on the Clearance Data and Munitions Accountability Log in Attachment 1. When a PDA is used, an entry will be made for each anomaly encountered by the dig team members. All fields will be completed by the TL in accordance with the pull-down menu instructions. The TL will turn over the PDA to the Data Manager at the end of the day. The Data Manager will check the data for completeness and accuracy, download the data to the project database, and upload the PDA with the next day's data.

When a PDA is not used, the dig teams will record anomaly data on the Clearance Data and Munitions Accountability Log. The TL will check each form for completeness and will turn them over to the SUXOS daily. All Clearance Data and Munitions Accountability Logs, digital photographs, and checklists will be turned over to the SUXOS at the end of each working day without exception. It is critical that data not be compromised through loss or improper handling. The SUXOS will identify errors in the forms, have the TL correct the errors, and turn the forms over to the Data Manager for entering into the project database.

A photograph will be taken of MEC and each piece of MPPEH recovered and annotated on the Clearance Data and Munitions Accountability Log to further document the item.

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6.0 RESPONSE ACTIONS

All MR work will be under the guidance of a Senior UXO Supervisor (SUXOS). A UXO Safety Officer (UXOSO) will implement the Site Health and Safety Plan (SHSP) and the Accident Prevention Plan (APP) and a UXO Quality Control Specialist will implement the Quality Control Plan (QCP) in accordance with the Quality Assurance Project Plan (QAPP).

6.1 RESPONSE TECHNIQUE

6.1.1 VEGETATION CLEARANCE

Vegetation will be cleared by UXO Technicians within the established AOC boundaries to a height between 3 and 6 inches above the ground surface using machetes, man-portable weed-whackers, and chain saws. Trees over three inches in diameter will not be cut, except for *Ha'u* vines up to six inches in diameter. Vegetation clearance will be limited to cutting of brush, vines, and tree limbs that would directly impede the movement of the detection equipment. Cut vegetation will be cut into approximately 2-foot lengths or mulched in order to minimize migration of cut vegetation to the Waikane Stream.

6.1.2 SURFACE CLEARANCE

Two 5-man MEC Teams perform all surface clearance efforts over an estimated 8-week period. Each team is led by one UXO Technician III (UXOTIII) Team Leader who oversees the work procedures of four UXO Technicians II/I (UXOTII/I). Archaeological Monitors will accompany each MEC Team for the duration of the fieldwork to ensure protection of archaeological features. Archaeological monitors will be escorted by UXO Technicians at all times while in the MRS.

The MEC Teams systematically traverse each work grid with analog detectors to detect, locate and mark all MEC items encountered, and recover any munitions debris that is free of explosives. The UXOTIII organizes the team and directs the movement of the team back and forth across the grid in a manner that ensures 100% coverage of each grid. As the team moves forward, the UXOTII/Is use the hand-held detector to assist them in locating metallic items that may be camouflaged by the soil or hidden in vegetation. Whenever the team encounters material suspected to be MPPEH, the UXOTII inspects the item. If the item is determined to be munitions debris or non-MEC related scrap the UXOTIII directs the UXOTII to recover the material, and it is removed from the grid and stockpiled with other munitions debris or non-MEC related scrap. If the item is UXO or a MEC item containing explosives the UXOTIII marks and records the location of the item and notifies the SUXOS. The SUXOS coordinates for disposal of the item by detonation. MPPEH items will be processed in accordance the procedures presented in Section 6.3 below.

6.1.3 INTRUSIVE INVESTIGATIONS

Subsurface investigation is accomplished using two 5-man MEC Teams, each consisting of a UXOTIII and 4 UXOTII/I. Work areas are subdivided into individual work grids, and these grids are further subdivided into individual search lanes to facilitate control of the clearance and to ensure complete coverage of each grid.

Prior to beginning intrusive operations, archaeological monitors conduct a visual inspection of the grid to determine if there are any archaeological features to be avoided. The team may shift subsurface investigation to a different grid if archaeological features must be avoided. Archaeological monitors will be called to the grid to inspect potential cultural material encountered during excavations, and will inspect the excavation locations after completion of the subsurface investigation to ensure that such features have been undisturbed or properly protected.

Individual search lanes are five feet wide, completely transect the grid, and are established in a pattern that ensures 100% coverage. A UXOTII/I is assigned to each search lane and systematically searches the lane using an analog detector. The technician moves forward, sweeping the instrument back and forth across the lane in a manner that keeps the tip of the instrument within four to six inches of the ground surface and forming a series of arcs across the lane which are no greater than three to four inches between arcs. During this operation the technician monitors the aural indications produced by the detector and identifies the location of any subsurface metallic anomaly encountered.

The UXO Technicians excavate and identify the source of each anomaly as it is encountered. The UXO Technicians will use hands tool such as shovels, spades and trowels and pry bars to excavate the anomalous features. Excavations will be initiated adjacent to the subsurface anomaly and continue until the excavated area has reached a depth below the top of the anomaly. Once the item is exposed for inspection, the UXO Technicians will determine whether the item is MEC, MPPEH, or other debris. If the item is MEC, a positive identification will be documented and confirmed by the UXOTIII and will be further processed as discussed in Section 6.4 below. If the item is MPPEH, the procedures presented in Sections 6.3 and 6.4 will be followed. All other debris will be collected and segregated from MPPEH to prevent comingling. Following the removal of the item BIP of MEC, the area will be rechecked with the analog detector to ensure no additional items remain.

If the anomaly has not been resolved when the target depth is reached in the excavation, work on the excavation is stopped and the reason for not resolving is entered in the “Comments” section of the *Surface/Subsurface Clearance Data & Munitions Accountability Log*: e.g., “Investigation Depth reached, anomaly not resolved.”

Throughout the survey the UXOTIII closely monitors the work of the UXOTIIs, records location data for the subsurface anomalies and the results of any investigations performed. Separate records are prepared and maintained for each individual work grid.

6.1.4 GEOPHYSICAL SURVEY

Geophysical data acquisition will be performed only in grids and transect for which subsurface investigation has been completed, with the intent of providing a geophysical map of any anomalies remaining within the completed grid/transect. These completed grids and transect will receive 100 percent DGM coverage. The geophysical survey of each grid will be accomplished by collecting data at regularly spaced, overlapping parallel lines. The spacing of these transects will be determined in the ITS; however, based on experience, it is anticipated that the spacing will be 0.75 meter. The heavy vegetation present in the AOCs will have been cleared prior to the subsurface investigation. The 0.75 meter line spacing provides for 25 percent overlap coverage when using the one meter wide EM61-MK 2 detector. The UXOQCS will perform random surveillance to maximize the consistency of the geophysical data collection. Attention will be paid to the consistent height of sensor above the ground as the operator is walking and between operators. Sensor height will be adjusted to be 40+2.54 centimeters above the ground (or as otherwise determined at the ITS for each DGM team. Data collection speed should be consistent across each grid line and between operators. Inconsistencies observed by the TL, operator, or the UXOQCS will be noted and immediately corrected. To measure data collection quality, a blind seeding program will be implemented. Prior to DGM, the UXOQCS will distribute coverage seeds in the grids and transect at a rate of 2 per grid or transect. The geophysical mapping team will not know where these items are located. During data processing Quality Control (QC) review, the known locations of the seed items will be evaluated. If any seed item is not located, a root cause analysis will be performed, and the grid will be subject to rework.

6.2 EXCLUSION ZONES (EZ)

EZs will be established at the AOCs while intrusive or disposal operations are being conducted. An EZ is a controlled area where only essential or authorized personnel are allowed while qualifying activities are taking place. Essential personnel are personnel whose duties require them to remain within the EZ to ensure that munitions operations are conducted in a safe and efficient manner. Authorized personnel include agency personnel and others conducting project-related functions that require them to be present in the EZ for a specific purpose for a limited time.

The size of the EZ is based on the greater of the K328 blast overpressure distance or the hazardous (versus the maximum) fragment distance of the MGFD and defines the explosives safety quantity distance (ESQD) arc for the site. Differing ESQD arcs may be required for the same AOC, depending on site conditions and the presence of inhabited buildings, public transportation routes, explosive storage magazines, etc. Formulas that take into account the Net Explosive Weight (NEW) of the MGFD and the site relationships (i.e., distance from exposed site to MGFD) are used to determine the ESQD for each site. The types of munitions present, or potentially present, at the target AOCs are listed in Table 6-1. These are the munitions that were considered in the selection of the MGFD for each AOC.

Table 6-1: Exclusion Zones MRS UXO 0022

MGFDs		**Exclusion Zones (ft) (1)**				
		Fragmentation Effects		**Blast Overpressure Effects**		
Description	**NEW**	**HFD**	**MFD**	**K328**	**K40**	**K50**
3.5 inch HEAT rocket	1.88	235	1,420	457	56	70
75 mm HE projectile, M48	1.64	234	1,701	411	48	60

(1) From DDESB Fragmentation Database.

Table 6-2: Controlling Exclusion Zones for MRS UXO 0022

Operation	**Sited As**	**EZ**	**Basis (4)**	**ESQD (ft)**
Manual operations(1)	Unintentional detonation	UXO teams	K40 of the MGFD	56(5)
Manual operations(1)	Unintentional detonation	Public and nonessential personnel	HFD of the MGFD	235(5)
MEC treatment up to 56.4 lbs NEW(2)	Intentional detonation	Public and all personnel	MFD of the MGFD (K-328)	1,420(4)(5)

Table notes:

(1) Manual operations involve excavating anomalies with hand tools.

(2) The maximum NEW for which blast overpressure (K328) does not exceed the MFD of the MGFD (based on Comp B explosive).

(3) MGFD is the 3.5-inch HEAT rocket with 1.88 lbs NEW of Comp B.

(4) Calculated using D=KW1/3, with W equaling the NEW of a single MGFD without donor charge.

(5) This distance can be reduced by employing engineering controls authorized by DDESB TP-16.

6.3 MEC AND MPPEH HAZARD CLASSIFICATION, STORAGE, AND TRANSPORTATION

MEC and MPPEH will be classified and stored per NAVSEA OP5, Volume 1; MEC will not be transported off-site.

6.3.1 MEC and MPPEH Hazard Classification

All MEC and MPPEH will be classified as Class/Division (C/D) 1.1. A systematic approach will be used for collecting, inspecting and segregating site debris. The approach is designed so that materials undergo a continual inspection/evaluation process from the time they are acquired until the items are removed from the site. Segregation procedures begin when the item is discovered by the UXO Technician. The UXO Technician makes a preliminary determination as to the item's classification into one of three categories and the UXOTIII confirms the item to be MEC, MPPEH or other debris.

6.3.2 MEC and MPPEH Storage

MEC will not be stored; MEC will be BIP or moved for demolition as discussed in Section 6.4. MPPEH will be collected at temporary MPPEH collection areas within each active grid or transect. MEC and MPPEH will be treated as discussed in Section 6.4 below.

6.3.3 MEC and MPPEH Transportation

MEC and MPPEH items will not be transported off-site. MEC determined to acceptable to move as discussed in Section 6.4.1 may be moved a different location on the MRS and consolidated with other MEC items for detonation. MPPEH items can be moved to the MPPEH Collection Point as discussed in Section 6.3.2 above.

6.4 MEC AND MPPEH DISPOSITION PROCESSES

All munitions items located within the AOCs are classified as MEC or as Munitions Documented as Safe (MDAS). Any other munitions are considered as MPPEH until they are re-inspected and certified as non-explosives contaminated.

All MEC and MPPEH items containing explosives, which are encountered during this project, are disposed of or vented/demilitarized by countercharging the munitions with an explosive donor charge and detonating the donor charge. All explosive disposal operations are performed under the direct supervision of the SUXOS and the UXOSO. Prior to the initiation of any explosive charge, the SUXOS ensures that all required coordination is made with local agencies and that the area is clear of non-essential personnel. Donaldson Enterprises Inc. (DEI) provides explosives delivery and blaster services, as they have personnel with the necessary Hawaii Blaster's Permit.

MEC items discovered during the workweek are marked or consolidated as appropriate for a demolition event to occur at the end of the week. Safety considerations require that MEC items which have been fired and are still fuzed must be blown in place (BIP). Where necessary to protect archaeological features, engineering controls (sandbags) will be placed around the MEC items and/or the archaeological feature to mitigate blast and fragmentation from reaching archaeological features.

Security guards will not be used, since a chain-link fence along the eastern, southern and western boundaries prevents public access to the site. A single locked gate at the western end of the site is the only access. The only road in the area is a single dirt track outside the fence along the southern boundary. Trespassers would first have to breach the fence, then cross Waikane Stream, and then ascend at least 100 feet in elevation over steep terrain and through jungle vegetation in order to reach the general area scheduled for clearance,

Locations of MEC items that may have been located during the week will be marked and recorded, and these items will be relocated for a demolition event to be conducted on the last day of each work week. DEI makes one explosives delivery each week so that any UXO items discovered during the field activities can be destroyed at the end of the week. Department of Navy (DON) and Department of Transportation (DOT) requirements are strictly observed for transportation of ammunition and explosives.

Two UXO qualified personnel identify MEC items/components encountered during the project. The UXO personnel record identification data of all MEC items/components, including condition, nomenclature, depth, location and disposition for inclusion in the RI Report. USA maintains a detailed accounting of all MEC/MPPEH encountered. Once the MEC has been destroyed or removed the hole is checked with a metal detector to assure that the initial item was not masking additional anomalies.

6.4.1 MEC Consolidation and Disposal

Where the SUXOS and the UXOSO can determine that a MEC item is not fuzed or is otherwise not configured to detonate, they may make the decision that it is acceptable to move. The MEC item can then be moved to a different location on the MRS and consolidated with other MEC items for detonation.

6.4.2 Munitions Debris Management

During field operations, USAE recovers, inspects and disposes of MDAS. Only personnel qualified as UXOTIII or above are allowed to inspect and classify MDAS. Containers such as 55-gallon drums are used for storage of munitions debris. Total weight of MDAS is documented during certification and verified upon receipt by the recycle facility. Once a container is loaded with MDAS, it is closed and sealed until it is received at the recycle facility. Upon shipment of the MDAS the SUXOS completes an Inert/Demilitarization Certification/Verification Manifest with the following certification:

> *"This certifies that the Material Potentially Presenting an Explosive Hazard listed has been 100 percent properly inspected and to the best of our knowledge and belief, are inert and/or free of explosives or related materials."*

The SUXOS signs the manifest to certify inspection of the scrap and the UXOQCS signs as the verifier. In accordance with OP 5, Ammunition and Explosives Ashore, the SUXOS and UXOQCS will be authorized in writing by the NAVFAC PAC Commander to certify and /or verify munitions debris shipped off the project site. USAE subcontracts Timberline Environmental Services to coordinate the shipment, shredding and melting of MEC Scrap at a mainland facility. The recycling facility verifies the weight, signs and returns the shipping documentation and provides USAE with certification that the material will be crushed, shredded, and or smelted prior to release for resale. The scrap containers are sealed and labeled and USAE tracks all documentation from cradle to grave and includes all documentation in the RI Report.

6.5 EXPLOSIVE SOIL

Not applicable

6.6 CONTAMINATED BUILDINGS

Not applicable.

6.7 OPERATIONAL RISK MANAGEMENT (ORM)

As required by OPNAVINST 3500.39, all operations undertaken by or for the DON must incorporate ORM principles into all phases of planning, operations, and training. Since munitions response actions involve inherent risks, the PM and UXOSO will evaluate those risks using facts, prudence, experience, judgment, and situational awareness.

Under certain conditions, and on a case-by-case basis, authorized visitors will be granted access to the EZ when operations are being conducted, provided that the following requirements are fulfilled:

- Access is limited to essential personnel and authorized personnel.
- The UXO Safety Officer (UXOSO) has completed an operational risk assessment.
- The maximum number of persons allowed in the EZ at one time will be determined by the UXOSO. The ratio of UXO-qualified escorts to visitors will be determined by the UXOSO at the time of the visitation.
- Persons requesting access to the EZ must demonstrate a legitimate need for access and obtain authorization from the Navy, Contractor Project Manager, and UXOSO; they must also submit their access request well enough in advance for the UXOSO to schedule an escort.
- Visitors must receive a site-specific briefing explaining the hazards and safety procedures associated with the EZ and must acknowledge the receipt of the briefing in writing.
- Authorized visitors must be escorted by UXO-qualified personnel at all times.

Any authorized visitor who violates established safety procedures will be immediately escorted out of the EZ for the visitor's own protection and to protect essential personnel in the EZ.

These site-specific procedures addressing EZ access have been developed for this project in accordance with NOSSA Guidance (NOSSA 2006).

Table 6-3: Operational Risk Management

		Mishap Probability (1)			
		A	**B**	**C**	**D**
Hazard Severity (2)	I	1	1	2	3
	II	1	2	3	4
	III	2	3	4	5
	IV	3	4	5	5

Mishap Probability (1)	**Hazard Severity (2)**	**Risk Assessment Codes**
A - Likely to occur immediately **B -** Probably will occur in time **C -** May occur in time **D -** Unlikely to occur	**I -** May cause death **II -** May cause severe injury **III -** May cause minor Injury **IV -** Presents a minimal threat	**1 -** Critical **2 -** Serious **3 -** Moderate **4 -** Minor **5 -** Negligible

Table notes:

(1) Mishap probability is the probability that a hazard will result in a mishap or loss, based on an assessment of such factors as location exposure, affected populations, experience, or previously established statistical information.

(2) Hazard severity is an assessment of the worst credible consequence that can occur as a result of a hazard. Severity is defined by potential degree of injury, illness, property damage, loss of assets, or effect on mission. The combination of two or more hazards may increase the overall level of risk. For the munitions encountered or believed to be present, consider the munitions and fuzing type and configuration, and its armed/unarmed status.

Table 6-4: Hazard Analysis Matrix for MRS X

Process Step	Hazard	Triggering Event	Initial Risk Index	Hazard Mitigation	Final Risk Index
1	Manual MEC removal operations	MEC reacts to impact or movement during soil removal	C/II/3	Initial excavation beside anomaly excavation with hand tools	D/IV/5
2	Receipt, handling, holding of donor charges	MEC reacts to impact, heat, friction, Electrostatic discharge	C/II/3	Same-day donor charge delivery; detonators stored separately from main charges in ATF-approved day box; all personnel will wear cotton clothing; demo ops will not take place if electrical storm ≤6 miles	D/IV/4
3	Recovered MEC treatment by Open Detonation	MEC and donor charges react to impact, heat, friction, electrostatic discharge	C/II/3	All demo op personnel trained; 1,420-ft EZ established; all personnel will wear cotton clothing; demo ops will not take place if electrical storm ≤6 miles	D/IV/4

6.7.1 CONTINGENCIES

In the advent that MEC is encountered that must be blown in place (BIP) and the detonation will impact cultural or archeological sites that cannot be protected by engineering controls, the SUXOS will notify the RPM who will request Explosive Ordnance Disposal (EOD) support.

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7.0 QC/QA

USAE will use a three-tiered QC process (preparatory, initial and follow-up checks) to ensure the data collected during the RI phase is sufficient in quality and quality to support development of the FS. The QA program will be based upon the approved QC program and administered by a third party QA contractor designated by the Navy.

7.1 QC IMPLEMENTATION

The three-tiered QC process requires the UXOQCS conduct audits of each Definable Feature of Work (DFW) listed in Table 7-1. Table 7-1 identifies the DFW, the QC requirements and Corrective Action Criteria should the audit identify non-compliance of the work performed on the DFW.

- A preparatory phase inspection will be performed prior to the beginning of each DFW. The purpose of this inspection will be to review the work scope and applicable specifications and verify that the necessary resources, conditions, and controls are in place and compliant before the start of work activities.
- An initial phase inspection will be performed for each DFW once a representative sample of the work has been completed. The purpose of the inspection will be to check the preliminary work for compliance with procedures and contract specifications, verify inspection and testing, establish the acceptable level of workmanship, review the minutes of the preparatory phase, and check for omissions and resolve differences of interpretation.
- A follow-up phase inspection is performed each day that work on a DFW is performed. The purpose of the inspection is to ensure continuous compliance and level of workmanship. The Project QCM will observe the same activities as under the initial inspection and ensure that discrepancies between site practices and approved specifications are identified and resolved.

Table 7-1: QC Criteria for DFWs

Definable Feature of Work	QC Requirements	Corrective Action Criteria
Mobilization/Site Preparation	• Verify all personnel receive all required site orientation (e.g. review and sign-off on all site-specific plans) and site-specific training • Verify the ITS is constructed in accordance with the DQO and SOP • Verify each operator and instrument is certified in the ITS prior to use on the project • Verify all boundary points and grid corners meet the tolerances required in the DQO • Ensure vegetation is cut or removed to a sufficient level to support the DGM survey.	• Prior to beginning work on-site, all personnel will receive site orientation and site-specific training • Issue a Deficiency Notice and a causal analysis with corrective action requirements on ITS construction • Instrument and operators will not proceed with on-site work until certified in the ITS • Issue a Deficiency Notice and a causal analysis with corrective action requirements on boundary and grid corner placements • Return any vegetation removal areas not meeting specifications to production for rework.

Definable Feature of Work	QC Requirements	Corrective Action Criteria
Surface Clearance	• Conduct a instrumented assisted visual check of no less than 15% of each surface grid to verify the compliance of the surface clearance effort	• Issue a Deficiency Notice and a causal analysis to production for rework of any deficient grids. All reworked grids will undergo an additional QC check
Intrusive Operations	• Verify archaeological monitoring is conducted prior to initiating intrusive operations • Verify all anomalies are investigated to required depths (2 feet in recreational areas, 4 feet in residential/agricultural areas) • Verify that MEC/MPPEH are properly identified/classified independently by two UXO qualified personnel • Verify intrusive results are properly recorded through spot checks of each team's logbooks, PDA recordings, dig sheets, etc., prior to incorporating into the project GIS	• Ensure monitoring is conducted prior to initiating intrusive operations • Issue a Deficiency Notice and a causal analysis to production for rework of any deficient grids. • Issue a Deficiency Notice and a causal analysis to production for any miss-identified/classified MEC/MPPEH • Issue a Deficiency Notice and a causal analysis to production for any improperly recorded intrusive results
MEC/MPPEH Management and Disposal	• Verify that a 100% inspection and an independent 100% re-inspection is conducted on all MEC/MPPEH and is further classified as either MDAS or MDEH • Verify by random sampling, that material is handled in a manner to ensure no co-mingling of MDAS and MDEH occurs • Verify all MDEH is further processed to eliminate the explosive hazard in accordance with disposal SOP • Verify that all MDAS is properly containerized and the chain of custody is properly documented and maintained throughout the life cycle of the material.	• Issue a Deficiency Notice and a causal analysis to production for re-inspection of any improperly classified materials • Issue a Deficiency Notice and a causal analysis to production for re-inspection and separation of any materials determined to be improperly stored • Issue a Deficiency Notice and a causal analysis to production for any material improperly treated • Issue a Deficiency Notice and a causal analysis to production for 100% inspection and 100% re-inspection if the chain of custody is broken
Site Restoration	• Verify all excavation or demolition holes are backfilled and leveled with the surrounding surface • Verify all non-munitions related scrap is collected and appropriately disposed	• Issue a Deficiency Notice and a causal analysis to production for proper site restoration prior to grid turn over for QA processing • Issue a Deficiency Notice and a causal analysis to production for the proper disposal of non-munitions related scrap
Geophysical Survey	• Verify the instrument functionality (static repeatability) as established at the ITS • Verify along line measurement spacing at 98% <= 25cm along line maintain throughout the survey • Verify the test seed item is detected within the dynamic positioning and detection repeatability metrics	• Issue a Deficiency Notice and a causal analysis to production for the day's data unless test seed item is mapped with repeatable anomaly characteristics • Issue a Deficiency Notice and a causal analysis to production for data submittal resolution

Definable Feature of Work	QC Requirements	Corrective Action Criteria
		• Issue a Deficiency Notice and a causal analysis to production for data submittal resolution
Geophysical Data Processing and Interpretation	• Verify that collected data is reviewed, processes and interpreted in accordance with SOP-3	• Issue a Deficiency Notice and a causal analysis to production for data processing/interpretation resolution

7.2 QA IMPLEMENTATION

The QA program will be based upon the approved QC program and administered by a third party QA contractor designated by the Navy.

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8.0 TECHNICAL SUPPORT

8.1 EOD

The MCBH Kaneohe Bay EOD Detachment will support in the event that CWM is discovered or if an MPPEH item is located that cannot be identified by UXO Technicians. Waikane Valley Impact Area is owned and managed by MCBH Kaneohe Bay, and has been supported by MCBH Kaneohe Bay EOD since the U.S. Marines acquired the property.

8.2 UXO CONTRACTOR

All USAE UXO personnel will meet the requirements set forth in the Department of Defense Explosives Safety Board (DDESB) Technical Paper 18 (TP-18), Minimum Qualifications for Unexploded Ordnance (UXO) Technicians and Personnel, dated 20 December 2004.

The field management team for the RI/FS comprises a Site Manager, a SUXOS and two UXO Quality Control Specialists (UXOQCS and a UXOSO). The field RI teams consist of all UXO Technicians.

USAE field personnel on this project have completed the training requirements found in Table 8-1 as required for their specific responsibilities. Additional site-specific training IAW OSHA 29 CFR 1910.120 for Hazardous Waste Operations and Emergency Response (HAZWOPER), as well as Engineer Manual 385-1-1 (U.S. Army Corps of Engineers Safety and Health Requirements Manual), will be provided to all personnel upon their initial mobilization. Additionally, all USAE field personnel will participate in a Medical Surveillance Program, with the latest exam occurring within 12 months of field operations.

Table 8-1: Personnel Training

Training Course	Personnel Attending
40-Hour HAZWOPER Training	All personnel who have not previously received this training or who do not qualify for certification through documented experience or training equivalent to that in paragraphs (e)(1) through (e)(4) of 29 CFR 1910.120.
8-Hour Supervisor Course	All USAE management and supervisory personnel. This includes the SUXOS, UXOSO, UXOQCS, and UXO Technician IIIs (UXOTIIIs).
8-Hour Refresher Course	All site personnel, except those who have completed their initial 40-Hour HAZWOPER training within the past year.
First Aid and Cardiopulmonary Resuscitation (CPR) Training	At least two site personnel will have current first aid and CPR training.
30-Hour OSHA Construction Safety Course	Training Requirement for UXOSO IAW with EM 385-1-1, Section 01.A.17

8.3 PHYSICAL SECURITY

The boundaries of WVIA are protected from access by a chain link fence which extends to higher elevations which are largely inaccessible due to steep terrain. A single road runs along the southern boundary, with a locked gate at each end. These gates will be closed and locked while munitions response actions are underway.

9.0 ENVIRONMENTAL, ECOLOGICAL, CULTURAL, AND/OR OTHER CONSIDERATIONS

9.1 REGULATORY STATUTE, PHASE, AND OVERSIGHT

The WVIA munitions response action is being conducted under CERCLA, with oversight by Hawaii Department of Health.

9.2 ENVIRONMENTAL, ECOLOGICAL, CULTURAL, AND/OR OTHER CONSIDERATIONS

During the SI, 50 soil samples were analyzed for explosives content and nine heavy metals associated with the types of MEC expected at the site. Four samples exhibited concentrations exceeding action limits for copper and lead. During this RI field effort, soil samples will be collected and analyzed for copper and lead content.

There are no endangered species inhabiting the site, and an Ecological Risk Assessment conducted after the SI concluded that there is minimal risk to the ecology. Cultural sites exist at the lower elevations of the site that must be avoided or protected against impacts from MEC and MPPEH intrusive or disposal activities.

9.3 NON-EXPLOSIVE SOIL

Not applicable.

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10.0 RESIDUAL RISK MANAGEMENT

10.1 LAND USE CONTROLS

The Marine Corps plans to release the property from DOD control, under no restrictions if possible. The reasonably expected future land use will be as an access restricted “other than operational” range, which will be operated and managed by MCBH. Eventually, after all areas have undergone remediation, the land will be turned over to the public or to local government agencies. Prior to this transfer, the Navy will determine land use restrictions on all parts of the property to be transferred.

10.2 LONG-TERM MANAGEMENT

Access restrictions, inspection of fencing and gates, public education, and excavation restrictions are interim Institutional Controls that will be used to protect the public from exposure to ordnance. Interim engineering controls include fencing, signs, and control of gates at access points to the site. In addition to maintaining this program, deed notices or other legal instruments will also be used to inform future users of information related to past investigations for ordnance hazards. The final institutional controls, if any, will be determined upon completion of the WVIA Record of Decision.

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11.0 SAFETY EDUCATION PROGRAM

The MCBH will maintain an ordnance awareness program. This program is intended to familiarize local residents with the history of ordnance use, storage, handling, and disposal at WVIA; basic characteristics of ordnance items at WVIA; and the procedures that should be followed if a suspected ordnance item is encountered.

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12.0 STAKEHOLDER INVOLVEMENT

Public involvement is through a periodic Restoration Advisory Board (RAB), an approved Community Involvement Plan, in-place Institutional Controls (IC), and the Navy information website (www.mcbh.usmc.mil/g4/environ/WaikaneRAB.htm).

During on site MEC operations, the Navy and USAE Site management team will schedule briefings to inform the public as to on-going operations and address any concerns and/or questions.

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APPENDIX A. SIGNATURE PAGE

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Project Name: Waikane Valley Impact Area RI/FS	
Explosive Safety Officer or UXO Contractor Safety Officer	
Signature	
Printed Name	Date
MCBH Kaneohe Bay Environmental Department	
Signature	
Printed Name	Date
Remedial Project Manager	
Signature	
Printed Name	Date

APPENDIX B. FRAGMENTATION DATA REVIEW FORMS

Fragmentation Data Review Forms are provided for the following MGFDs:

- Primary MGFD - 3.5 inch HEAT rocket
- Contingency MGFD – 75mm HE projectile

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FRAGMENTATION DATA REVIEW FORM

Database Revision Date 12/31/07

Category:	HE Rounds	DODIC:	H600
Munition:	3.5" M28A2 Rocket Case	Date Record Created:	7/30/2004
		Last Date Record Updated:	7/30/2004
Primary Database Category:	rocket	Individual Last Updated Record:	Crull
Secondary Database Category:	3.5 in	Date Record Retired:	
Munition Case Classification:	Robust		

Munition Information and Fragmentation Characteristics

Explosive Type:	Comp B
Explosive Weight (lb):	1.88000
Diameter (in):	3.5000
Max Fragment Weight (lb):	0.052420
Critical Fragment Velocity (fps):	6126

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	235
MFR-V [Vertical Range of Max Weight Fragment] (ft):	1128
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	1420

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	56
Inhabited Building Distance (09 psi), K50 Distance:	70
Intentional MSD (0065 psi), K328 Distance:	457

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	3.92
Mild Steel:	0.71
Hard Steel:	0.59
Aluminum:	1.53
LEXAN:	4.52
Plexi-glass:	3.00
Bullet Resist Glass:	2.37

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.052420
Critical Fragment Velocity (fps)SB:	6126
Kinetic Energy 106 (lb-ft2/s2)SB:	0.9836
Required Wall Roof Sandbag Thickness (in)SB:	24
Expected Maximum Sandbag Throw Distance (ft)SB:	125
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.052420
Critical Fragment Velocity (fps)W:	6126
Kinetic Energy 106 (lb-ft2/s2)W:	0.9836
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	200

Print This Form

Close Form

FRAGMENTATION DATA REVIEW FORM

Database Revision Date 12/31/07

Category:	HE Rounds
Munition:	75 mm Mk I
Primary Database Category:	projectile
Secondary Database Category:	75 mm
Munition Case Classification:	Robust
DODIC:	
Date Record Created:	7/30/2004
Last Date Record Updated:	7/30/2004
Individual Last Updated Record:	Crull
Date Record Retired:	

Munition Information and Fragmentation Characteristics

Explosive Type:	TNT
Explosive Weight (lb):	1.64000
Diameter (in):	2.9528
Max Fragment Weight (lb):	0.153065
Critical Fragment Velocity (fps):	3479

Theoretical Calculated Fragment Range

HFD [Range to No More Than 1 Hazardous Fragment per 600 Square Feet] (ft):	238
MFR-V [Vertical Range of Max Weight Fragment] (ft):	1298
MFR-H [Horizontal Range of Maximum Weight Fragment] (ft):	1702

Overpressure Distances

Inhabited Building Distance (12 psi), K40 Distance:	50
Inhabited Building Distance (09 psi), K50 Distance:	63
Intentional MSD (0065 psi), K328 Distance:	411

Minimum Thickness to Prevent Perforation

4000 psi Concrete (Prevent Spall):	3.77
Mild Steel:	0.73
Hard Steel:	0.60
Aluminum:	1.50
LEXAN:	4.88
Plexi-glass:	3.31
Bullet Resist Glass:	2.71

Required Sandbag Thickness

Max Fragment Weight (lb)SB:	0.153065
Critical Fragment Velocity (fps)SB:	3479
Kinetic Energy 106 (lb-ft2/s2)SB:	0.9263
Required Wall Roof Sandbag Thickness (in)SB:	24
Expected Maximum Sandbag Throw Distance (ft)SB:	125
Minimum Separation Distance (ft)SB:	200

Water Containment System and Minimum Separation Distance:

Max Fragment Weight (lb)W:	0.153065
Critical Fragment Velocity (fps)W:	3479
Kinetic Energy 106 (lb-ft2/s2)W:	0.9263
Water Containment System:	1100 gal tank
Minimum Separation Distance (ft)W:	200

Print This Form

Close Form

APPENDIX C. ESQD MAPS

The following figures are provided:

- Figure 1 – Location Map
- Figure 2 – ESQD Map.

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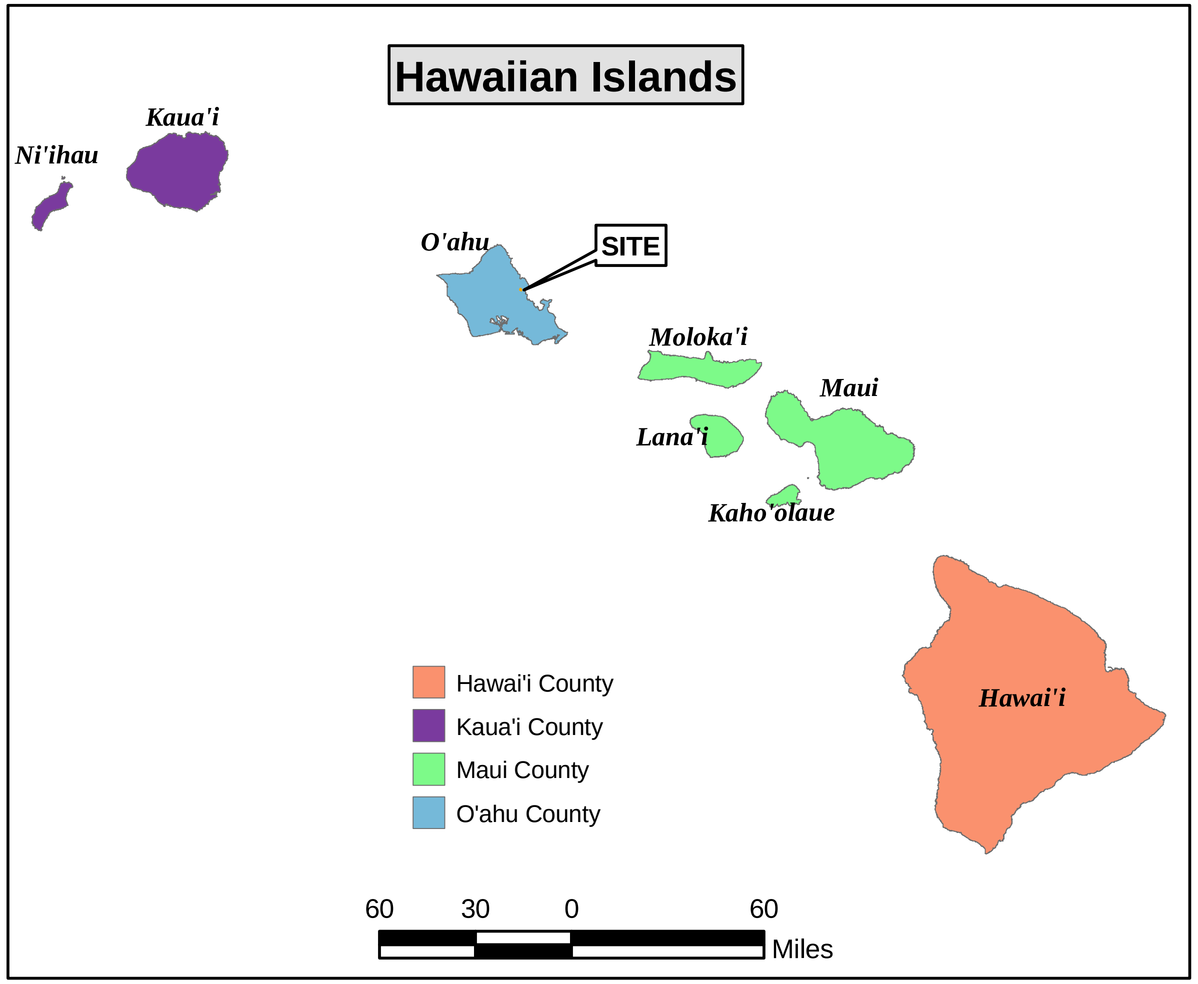
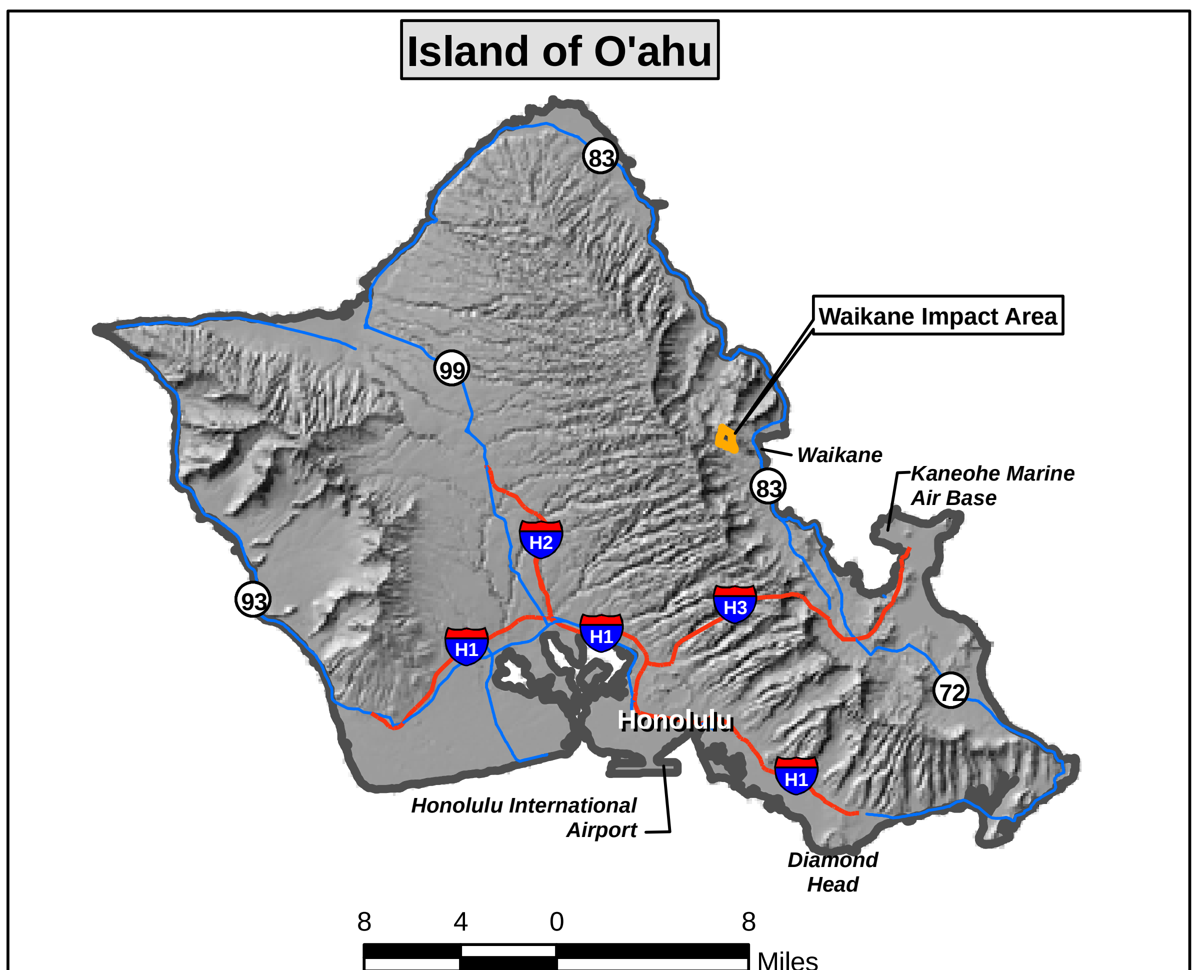
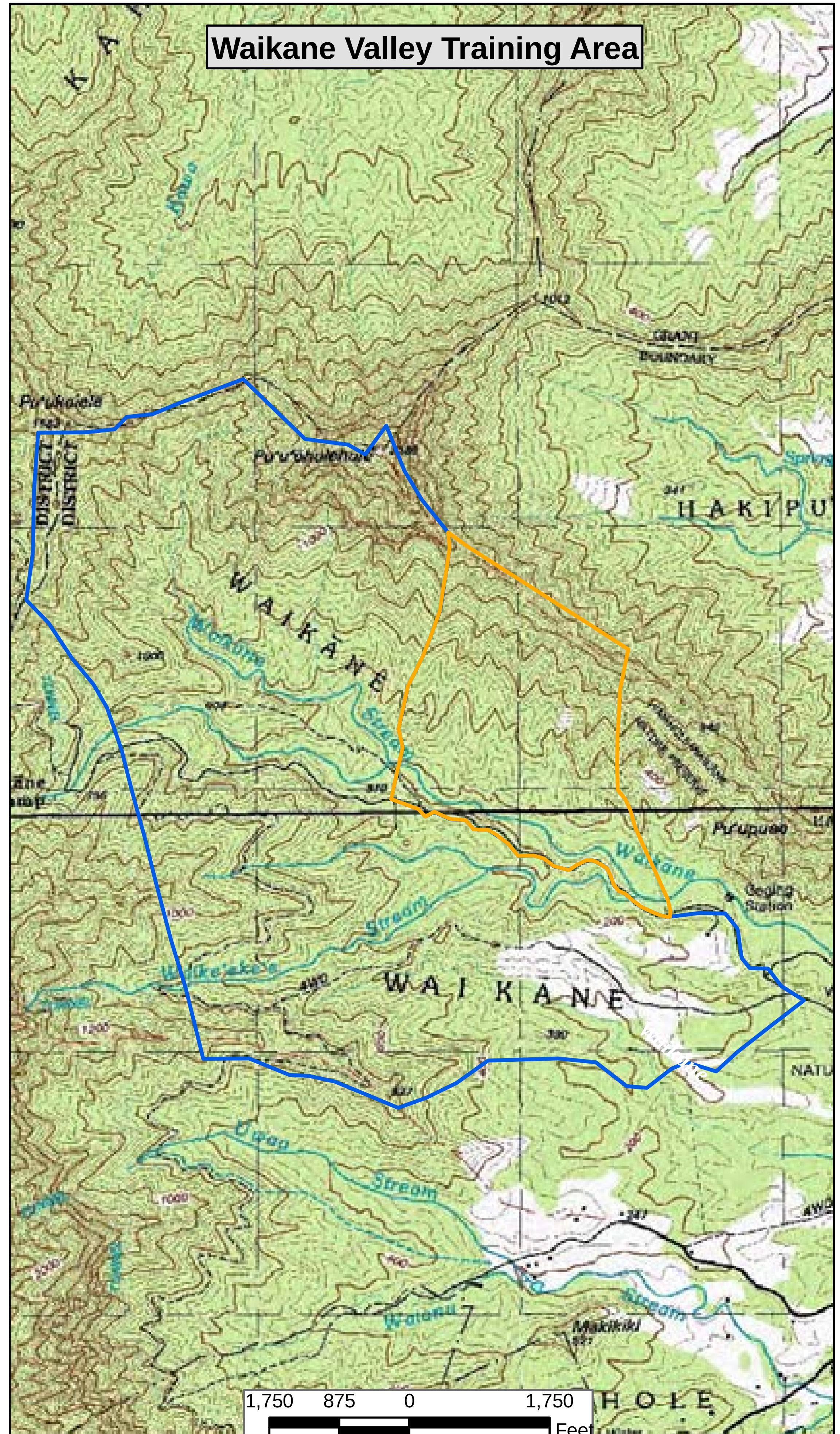






N

Data is projected to the State Plane Coordinate System:
Hawaii 4 Zone, NAD83, Units in Feet.

Figure 1

Location Map

Waikane Valley Impact Area
Koolaupoko District, O'ahu, Hawai'i

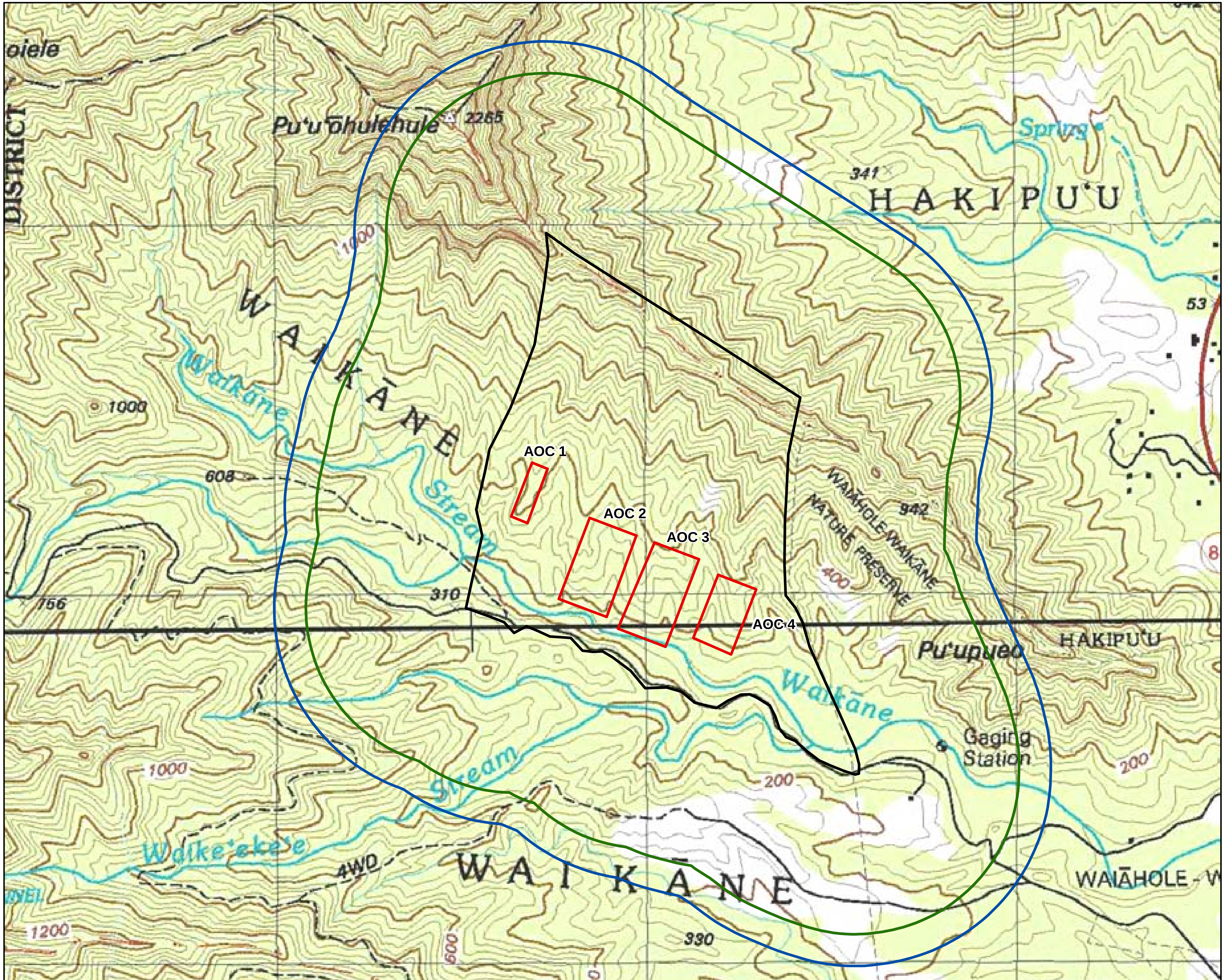
Legend

- Impact Area Boundary
- Waikane FUDS Boundary

USA Environmental, Inc.

Drawn By:	JAL	Scale:	Varies	Rev:
Checked By:		Date Drawn:	7-22-2009	
Submitted By:	RN	Revision Date:		

Path:
S:\Waikane\Work Plan\Location.mxd



N

850 425 0 850

Feet

Data is projected to the State Plane Coordinate System: Hawaii 4 Zone, NAD83, Units in Feet.

Figure 2

MSD Map

Waikane Valley Impact Area
Koolaupoko District, O'ahu, Hawai'i

Legend

- Suspected Target Locations
- Waikane Impact Area Boundary
- 1420 ft 3.5" HE Rocket MFR ESQD
- 1702 ft 75mm HE MFR ESQD

USA Environmental, Inc.

NAVFAC

Drawn By: JAL	Scale: 1 inch = 850 feet	Rev:
Checked By:	Date Drawn: 7-22-2009	
Submitted By: RN	Revision Date:	
Path: S:\Waikane\Work Plan\ESS_ESQD Map.mxd		